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[Special Editorial Correspondence, by Telegraph.]

THIRD ANNUAL MEETING OF THE PACIFIC COAST GAS ASSOCIATION.

SAN FRANCISCO, CAL., July 17th, 1895.

Dear JOURNAL: The Third Annual Meeting of the Pacific Coast Gas Association was brought to an end this afternoon, so far as the technical portion of the proceedings thereof was concerned; but much of the pleasuring remained for the afternoon and evening. And so much of it was there to be enjoyed that it is really Thursday morning which finds me "burning the midnight Welsbach" in arranging these despatches, for I am impelled to remember that Thursday is editorial day in Pine street, wherefore "copy" must be on hand in time to stay the compositors' demands. The meeting was a downright good one, no matter from what standpoint it be judged, there being an attendance of full three score, with quite a number of visitors, too. The latter included Mr. and Mrs. Daniel R. Russell, of St. Louis—it seems rather odd to have to call him or write him down anything other than "Dan.," for "Dan." he will always be to us—Mr. and Mrs. Walton Clark, of Philadelphia, and Mr. O. N. Guldlin, of Fort Wayne, Ind. It is true that some were absent whose "missingness" was felt, notably so in respect of Mr. J. B. Crockett, of the San Francisco Company, the "Father of the Association," but as his paths this year at this time lay in the direction of Europe, the Association, while it missed him, really did not feel that it should mourn about it, for was he not enjoying himself? Letters of congratulation and regret—congratulating the Association on its excellent prospects for a good meeting and regretting the inability of the senders to participate therein—were many; and a very fraternal one from the Western Gas Association was most heartily received. The weather was, during the entire time of the meeting, simply perfection, and only those who have enjoyed perfect Pacific Coast weather can fully appreciate what this means. The meetings were held in the very handsome hall of the San Francisco Company's office building, and in every way answered the purposes to which it was temporarily devoted. Right here I might just as well say that Mr. E. C. Jones, of the San Francisco Company—and if Mr. Crockett may be called the "Father" of the Coast Association, Mr. Jones is entitled to the credit of bringing on the infant—cannot be given sufficient praise and thanks for the cleverness and perfectness of his arrangements for the meetings and for the heartiness of his personal attentions to the members and their guests. Nor in this do I wish to detract in the slightest from the successful ministrations of the other gentlemen comprising the Arrangements Committee, who were untiring in their attentions; but Mr. Jones was the seemingly ubiquitous one. Another important factor in the proceedings, as contributing to the complete success of the meeting, was the San Jose Light and Power Company, of San Jose, Cal., for its President, Mr. C. W. Quilty, in his capacity as President of the Association, not only acted like a veteran director of public assemblages, but also read an address that was well worth listening to, and which will be well worth reading, when it appears in your regular report of the proceedings—here let me stop to add that the JOURNAL was designated the official organ of the Association. Again, the San Jose Company's Superintendent, Mr. O. M. Gregory, read a

very interesting paper, and another San Jose man was very much in evidence in the paper list and in the discussions. So, take it all in all, San Jose was quite well to the fore in carrying on the good work for which the Association was organized. Secretary Britton, in his quiet, businesslike way, ably aided the President in his direction of the meeting, and was also on hand whenever Mr. Jones called for aid.

The paper list was a downright good one. In the first place the President's address, as before remarked, was instructive, interesting and amusing, the latter feature being readily comprehended when one remembers that the San Jose Light and Power Company has so disturbed its competitor for lighting favor in the San Jose field—the Electric Improvement Company—through its clever presentation of the merits of the Welsbach lamp, that the Electric Improvement Company has taken the preliminary steps towards the construction and operation of a gas plant, in order to stem, if possible, the shrinkage in its profits from the inroads thereon of the Welsbach lamp. Mr. J. L. Howard, General Manager of the Oregon Improvement Company, read an excellent paper on "Welsh Anthracite Coal;" Mr. J. B. Grimwood treated the subject of "Technical Gas Analysis;" Mr. John Clements, of Red Bluff, Cal., had something to say on "Economies in Small Gas Works;" Mr. T. R. Parker, of Napa, Cal., contributed a budget of "Wrinkles;" Mr. E. C. Randall, of San Jose, wrote on the matter of "One Year's Experience with Welsbach Burners;" Mr. O. M. Gregory, also of San Jose, contributed a chapter or two on "The Treatment of Our Customers;" Mr. H. E. Adams, of Stockton, Cal., dilated on the subject of "Producer Gas," and Mr. E. C. Jones handled in masterly and precise fashion the alluring topic of "Calcic Carbide," illustrating his remarks by an exhibition of the light produced from the combustion of acetylene. The Question Box, which held quite a store of wealth in queries, completed a most interesting technical programme. The officers elected were:

President—E. C. Jones, San Francisco, Cal.

Vice-President—F. H. Eichbaum, San Francisco, Cal.

Secretary and Treasurer—Jno. A. Britton, Oakland, Cal.

Directors—G. W. Wilson, Vallejo, Cal.; C. O. G. Miller, San Francisco, Cal.; B. U. Steinmann, Sacramento, Cal.; O. M. Gregory, San Jose, Cal.; S. B. Cushing, San Francisco, Cal.

The next meeting will be held in San Francisco. I would like to be able to add that the exhibition of gas appliances was as successful as the meeting itself, but such was not the case. The exhibit was held in the meeting hall, and the display was confined to a meager show of models and small apparatus. Next year this verdict will undoubtedly be reversed. I should have said before that 16 new members were put upon the lists. On Tuesday evening a very pretty banquet was spread in "Delmonico's," which was enjoyed to the full. The banquet room was beautifully illuminated with Welsbach lamps, and one inquirer after things curious evolved the fact that the number of lamps just equalled the number of banqueters. President Quilty was an excellent Toastmaster, and the affair was in every sense enjoyable and hospitable. Features of the speechmaking were the efforts of Messrs. Jones, Britton, Eastland, Clark, L. P. Lowe, and "Dan." On the afternoon of Wednesday an excursion by steamer to the quarters of the Pacific Yacht Club, where an elegant luncheon was spread, was the feature; and was followed by an inspection of the stations of the Gas Companies at North Beach. In the evening the members and guests visited the Columbia Theater and witnessed a vivacious performance of "One of Our Girls," with Helen Dauvray in the leading part, and this brought the Third Annual Meeting of the Coast Association to a close. When I say that it was in every sense a success, I have but told the simple truth.—C.

DEATH OF MRS. JOHN P. KENNEDY.—It is with regret that we chronicle the death of Mrs. John P. Kennedy, widow of the late Mr. John P. Kennedy, for many years President of the Mutual Gas Light Company, of this city, whose demise occurred on the 2d inst. The funeral services were celebrated on the 6th inst., at the home of her daughter (Mrs. Luther Conklin), on Beach avenue, Larchmont, N. Y., to which she had been removed from her New York residence while in feeble health some weeks ago. The services were conducted by the Rev. Dr. John S. Bacon, of Corning, N. Y., and the interment was made in the family burial plot in Woodlawn Cemetery. Mrs. Kennedy was in her 72d year.

NOTES.—The proprietors of the Paris (Ills.) Gas Light and Coke Company have agreed to furnish gas to the public buildings for $1.50 per 1,000 cubic feet.——The Sandusky (Ohio) Gas Light Company has contracted with the U. G. I. Company for one of its water gas settings, of a quarter million daily capacity, the apparatus to be of the standard double superheater style, including all the latest improvements. The apparatus will replace a Loomis producing plant, heretofore operated by the local Company.

Illumination.

[A paper read by PROF. W. IVISON MACADAM, F.R.S.E., F.I.C., F.C.S., etc., before the Incorporated Gas Institute.]

Within the past few years the theory of the decompositions taking place in flames has undergone much change, and I thought that my communication before this Institute might fairly consider the various alterations now rendered necessary by the exhaustive researches of Smithells, Lewes and others. I do not propose to criticise the labors of these investigators so much as simply to put the results before you in as unvarnished a manner as possible, and to point out, so far as I can, the differences existing between the investigators. My paper was originally intended to take the form of a lecture, but on its being pointed out to me that, by following this course, discussion would be impossible, I readily acquiesced in the suggestion of your Council that the communication should take the form of a paper.

The older teaching laid down distinctly that the four zones in an ordinary luminous flame were: First, the smaller and lower slightly luminous portion; second, the luminous area; thirdly, the outer area, practically non-luminous; and lastly, the central or dark zone. In the first of these zones, or the lower slightly luminous area, we had a complete combustion, with the consequent heating of the remaining unconsumed gas; in the luminous area, the hydrogen was first burned, with the deposition of carbon, which, by its incandescence and consequent combustion, yielded light; while the outer practically non-luminous area was formed by the completed combustion products. The dark central area was due to the issuing non-burned gas; and it was greater or less according to the form of burner used, and the pressure under which the gas issued from the burner. The form of the flame, or the body used to produce the flame, was immaterial, so long as there were present hydrocarbons which had not been previously mixed with air. You can notice these zones in the three most common forms of flat flame—the union jet, the slit union jet, and the batswing jet; and you can also note the areas in a candle flame. In the atmospheric or Bunsen jet, the luminous area is wanting. In the newer researches, the zones or areas are unchanged, the products that are formed in the slightly luminous lower area and the outer zone remain unchallenged, while the center zone is still accepted as consisting of unburned gas, but the luminous area is a battlefield undecided.

Through the kindness of Professor Smithells, of Leeds, I am enabled to show you on the screen the series of slides with which he has illustrated his results, and the description of which I shall give you in his own words. He says: "The best way to study flame structure seems to me to consist in tracing the development of the flame. By using a very small quantity of combustible—that is to say, in the case of gases by almost turning off the tap, and, in the case of solids and liquids by having a very close-cropped wick—we obtain a tiny flame, which is ordinarily called non-luminous. It * * * consists of a hollow, bright blue cone, surrounded by a lilac colored border. If more gas be turned on, or if the wick becomes longer, a luminous spot is developed in the flame. This spot is at first a small fraction of the whole flame, but as the supply of combustible is increased it rapidly extends; the original inner cone becomes a 'vestige,' and forms, in fact, the blue region. Still the original formation is evident, the luminous spot being indented at points corresponding to it. The question now arises—Is the non-luminous flame a single or a double cone; and in any case, what chemical changes are taking place in it? I think an answer to this question may be obtained by carefully watching the change undergone by a luminous flame when air is gradually added to the gas prior to combustion. For this purpose a small flame from a Bunsen burner, with the air holes at first closed, may be employed. If attention be fixed on the blue and on the faintly luminous regions of the flame, and the air holes be now slowly opened, the flame loses luminosity, and the two regions grow more distinct, and ultimately become, without any perceptible break of continuity in the process, the inner and outer cones of the ordinary Bunsen flame."

The author then, by means of a series of lantern slides, showed certain of the diagrams accompanying Prof. Smithells' published lectures on this subject, and resumed his quotation from Prof. Smithells in these words: "If the conclusion be admitted that the blue and the faintly luminous regions of an ordinary flame correspond to the inner and outer cones of a Bunsen flame, then, in accordance with the results detailed, we must consider the blue region to mark *incomplete* combustion (CO, H_2, CO_2 and H_2O being the chief substances there originating), and the faintly luminous part to mark *completed* combustion (the CO and H_2 above named being burnt to CO_2 and H_2O). In other words, I conclude that there is no essential difference in kind between an ordin-

ary luminous flame and a so-called 'non-luminous' flame. The latter may be regarded as a gas-air flame, with the blue and the non-luminous regions at a maximum, and the yellow luminous region at a minimum; while the luminous flame is to be regarded as a gas-air flame, with the blue and the non-luminous parts at a minimum, and the yellow luminous region at a maximum."

Smithells' conclusions, therefore, point to the very important fact that, where you have compounds of carbon and hydrogen, and these bodies come in contact with oxygen, the carbon is first oxidized with the liberation of the hydrogen, which is afterwards converted into steam by oxidation.

The cause of the luminosity of the flame has also been assailed, chiefly by Professor E. Frankland, who has shown that certain hydrocarbons, when highly heated, become luminous. But, on the other hand, it has been distinctly shown by Soret and others that solid particles are present in the luminous flame. Professor Frankland has, however, promised to return to the charge, and we will wait developments.

Smithells has devised a most ingenious instrument, by means of which the two flames of the Bunsen burner can be divided, and the products separately tested. When the ordinary Bunsen flame is turned low, the flame gradually becomes unsteady, and finally passes down the tube. If, however, a constriction is made in the tube, it is found that the extra current so induced leads to the flame becoming once more steady; but, on examination, it is found that there are in reality two flames, one at the upper part of the tube, and a second at the constriction. I show you a slide representing this experiment. To prove that this arresting of the flame is simply due to the extra current induced by the restriction of the tube, he has also performed the experiment with a tube of regular bore, into which is introduced a glass rod. In that part of the tube in which the glass rod is, the upward current of gas is slightly more rapid, with the result that the descending flame is arrested at the apex of the rod. A further and more beautiful result has, however, been obtained by the use of two tubes of different bores. If the thinner tube is pushed upwards until it is above the mouth of the larger tube, and the gas is lighted, we get the ordinary Bunsen flame. The inner tube is then lowered until it is some distance below the mouth of the outer tube, and the flame passes to the larger tube. If this flame is reduced until it becomes somewhat unsteady, and the inner tube is then again lowered, it will be found that the inner portion of the flame passes down the outer tube and rests on the inner. By means of a side tube fused into the outer tube, the products of the combustion taking place at the inner zone can be readily withdrawn without passing through the upper flame, and thus all possible chance of change due to extra heat is got rid of. Smithells has made a large series of analyses of these gases, and he finds them to consist of carbonic oxide, hydrogen, carbonic anhydride, and water vapor, with nitrogen derived from the air used to burn the gas. The products of the outer flame are, of course, carbonic anhydride and water. In some experiments made with pure ethylene (C_2H_4), and in which the gases were burned in the inner tube with such a supply of air that the carbon was not completely consumed, a slight proportion of acetylene (C_2H_2) was detected. Benzene also yielded acetylene. In the former case, the proportion of undecomposed hydrocarbons ranged from 0.8 to 1.3 per cent., and with benzene the amount was 0.6 per cent. Smithells explains the luminosity of the flame to be due to carbon formed by the decomposition of hydrocarbons by the heat of the primary combustion. The reaction is probably expressed by the equation—

$$3C_2H_4 = 2CH_4 + 4C + 2H_2.$$

Professor Lewes considers that, on the gas leaving the jet, the hydrogen of the coal gas rapidly diffuses to the outer part of the flame, and is there burned. The methane diffuses more slowly (but also goes outward), and is consumed. The heat produced by the combustion of these two gases raises the gas to a temperature of about 500° C., which gradually ascends to 1,000° C. At this temperature, the unsaturated hydrocarbons and the higher saturated carbon and hydrogen compounds are decomposed into acetylene, which if the heat did not exceed 1,000° C., would polymerize into benzene, naphthaline, etc. The heat, however, continuing to rise, reaches 1,200° C., when, instead of polymerization, the acetylene is dissociated into carbon and hydrogen. The carbon during its after incandescence is then the source of the light.

I have thus far attempted to lay the various newer theories before you—perfectly unvarnished and unbiassed. Personally, I am inclined to follow the teaching of Smithells, as I cannot suppose that the very minute proportions of acetylene found on analysis by both Smithells and Lewes can seriously affect the luminosity of the flame, although it may assist.

The flames which I have up till now considered have—whatever the changes may be—owed their luminosity to elements contained within the gas. When the rays obtained from these flames are passed through the prism, and the spectra thus produced are examined, it is found that the part of the spectrum which consists of heat rays is much more highly developed than the light rays. Although the heat rays play a very important part in decomposing the carbon and hydrogen compounds, yet there can be no doubt that they are at present in considerable excess, and the more is such the case with the gases obtained from soft coals and of poor luminosity. Moreover, by completing the combustion of the light giving hydrocarbons, the light rays may readily be converted into heat. If, then, a solid body capable of being readily raised to incandescence without actual oxidation, be introduced into the non-luminous flame, light is evolved. Such is the theory on which the various incandescent burners which have been brought out are formed.

I have made a series of tests with the best known of these burners—the Welsbach—for the purpose of determining their value when used with gases of varying quality. The burners used were of the "S" and "C" sizes, and were tested both with and without regulators. The gases employed were: (1) Edinburgh city gas; (2) Arniston (Mid-Lothian) cannel coal gas; (3) a gas made from ordinary soft nuts; (4) oil gas. The Edinburgh city gas, when tested on my photometer, gave for each 5 cubic feet consumed a light equal to 24.26 candles, or 4.85 candles for each cubic foot consumed. The Arniston cannel gas was made from that coal in my laboratory, and was of 35.62-candle power, which is equal to 7.12 candles for each cubic foot burned. The soft nuts were obtained from Messrs. Deans & Moore, and when distilled gave 6,720 cubic feet of 14.02-candle power gas, or 2.80 candles for each cubic foot burned. The oil gas was made of two qualities: (*a*) From lighthouse oil of 807.47 specific gravity, and (*b*) from burning oil of 796.13 specific gravity. The lighthouse oil gave me 19,584 cubic feet per ton of oil, or 86.12 cubic feet per gallon, of a 60.02-candle power gas; and the burning oil gave 23,659 cubic feet per ton, or 74.09 cubic feet per gallon, of a 56.62-candle power gas.

The apparatus used in making the oil gas was the Paterson or Kirkintillock plant, which I find to be the most readily worked in the laboratory. The retort is made of cast iron, with two or more tubes inserted into it. These tubes pass almost to the back of the retort, and the oil, after being vaporized, passes through the retort to the ascension pipe, which is in front. The gas obtained is of good quality and similar in quantity to that obtained in Keith's constricted retort or in Pintsch's double retort, but not so large as is obtained in the Peebles retort, which yields no condensable products. For small tests, the Paterson retort is readily heated and worked, although for larger installations I favor the more economical Peebles process.

The more full details as to the coals and gases will be found in the following tables:

Composition of Coals and Gas.

——	Arniston (Mid-Lothian) Cannel Coal.	Deans and and Moore's Nuts.	Edinburgh and Leith Gas.
Volatile matter	45.07 per ct.	....	....
Coke	52.49 "	....	....
Carbon in coke	48.52 "	....	....
Ash in coke	3.81 "	....	....
Gas per ton of coal	11,386 cu. ft.	6,720 cubic ft.	....
Candle power of gas (5 cubic feet)	35.62 candles.	14.02 candles.	....
Candle power of 1 cubic ft.	7.12 "	2.80 "	24.26 candles.
Value of 1 cubic foot gas	854.88 grains.	336 grains.	4.85 "
Value of 1 ton as gas	1,390.52 lbs.	322.56 lbs.	582.24 grains.

Oil Gas.

——	No. 1—N. Lighthouse Oil (1895).	No. 2—Burning Oil.
Specific gravity of oil	807.47	796.13
Flash point of oil	142° F.	122° F.
Gallons of oil per ton	227.409	281.36
Gas from 1 gallon of oil	86.12 cubic ft.	74.09 cubic ft.
Gas from 1 ton of oil	19,548 "	23,659 "
Candle power of gas (5 cubic feet)	60.02 candles.	56.62 candles.
Candle power of 1 cubic foot	12.00 "	11.32 "
Value of 1 cubic foot of gas	1,440.48 grains.	1,358.88 grains.
Value of gas from 1 ton of oil	4,030.05 lbs.	4,592.82 lbs.

The Welsbach burner is now so well known that I need not detain you long by description. It is practically a Bunsen burner with an an-

nular flame, in the center of which is a support holding a mantle, which is to be rendered incandescent. The flame is protected by a glass or mica chimney. The "D" burner is exactly similar to the "C" and "S," excepting in the flame protector, which is specially adapted to outside work. The "S" burner was tested with (*a*) Edinburgh gas, (*b*) Arniston cannel gas, and (*c*) soft nut gas. The results are given in the next table.

The figures show that with Edinburgh gas of 4.85 candle power for each cubic foot consumed, the "S" burner gave from 9.4 to 10.66-candle power.

Welsbach "S" Burner (White Glass Chimney).

Gas Used, and Value per Cub. Foot.	Cubic Feet of Gas Consumed.	Pressure on Burner.	Candle Power Found.	Candle Power per Cu. Ft. of Gas Burned.
Endinburgh— 4.85-candle power.....	2.50	10-10ths	23.50	9.40
	3.00	13-10ths	32.00	10.66
	3.20	17-10ths	32.00	10.00
Arniston— 7.12-candle power.....	2.30	10-10ths	17.00	7.39*
	1.45	4-10ths	18.50	12.75
Deans & Moore's soft nuts— 2.80 candle power.....	2.20	8-10ths	30.00	13.63
	3.60	20-10ths	34.00	9.46*

* Gas in excess.

With Arniston cannel gas (7.12-candle power per cubic foot), the value varied from 7.39 candles when an excess of gas was used, to 12.75 candles when the consumption was 1.45 cubic feet at 4-10ths pressure. With low quality gas (soft nuts of 2.80-candle power), the highest return was obtained with a consumption of 2.2 cubic feet at 8-10ths pressure, and was equal to 13.63 candles per cubic foot. The increase of illumination was, therefore, with Edinburgh gas as 1 to 2.19; with Arniston cannel gas, as 1 to 1.79; and with poor quality coal gas, as 1 to 4.87.

With the "C" or common sized burner, a greater number of tests were carried out, and an attempt was made to burn oil gas. Tests were also made with regulators; but, as will be readily noticed, the apparatus at present supplied is evidently not well adapted to the work. The details are in the following table:

Welsbach "C" Burner.

Gas Used, and Value per Cubic Foot.	Cubic Feet of Gas Consumed.	Pressure on Burner.	Candle Power Found.	Candle Power per Cu. Ft. of Gas Burned.	
Edinburgh— 4.85-candle power.....	3.20	17-10ths	68	21.25	(*a*)
	3.20	18-10ths	62	19.37	(*b*)
	3.20	16-10ths	48	15.00	(*c*)
Arniston— 7.12-candle power.....	1.65	3-10ths	27	16.36	(*d*)
	2.50	13-10ths	58	23.20	(*e*)
	2.60	13-10ths	57	21.92	(*f*)
Oil gas— 12-candle power.....	2.20	10-10ths	41	18.63	(*g*)
Deans and Moore's soft nuts— 2.80-candle power.....	2.20	5-10ths	9	4.09	
	3.10	10-10ths	41	13.22	(*h*)
	3.20	20-10ths	41	12.81	
	2.90	10-10ths	34	11.72	(*i*)
	3.10	20-10ths	38	12.25	
	3.20	10-10ths	41*	12.81	
	3.20	10-10ths	39†	12.18	(*j*)
	3.20	10-10ths	29‡	9.06	

Remarks.—(*a*) No regulator on burner. (*b*) 2¼ regulator on burner. (*c*) 2¼ regulator on burner. (*d*) No regulator. Slight carbon deposit on burner. (*e*) 2¼ regulator on burner. Much carbon deposit on mantle. (*f*) 2¼ regulator on burner. Luminous flame 3 inches above mantle. Large carbon deposit on mantle. (*g*) 2¼ regulator on burner; 1½ inch deposit of carbon on mantle. Luminous flame 2¾ inches above mantle. (*h*) No regulator. (*i*) 2¼ regulator on burner. (*j*) No regulator.

Note.—A white glass chimney was used in all cases except the last three, in which the chimneys were of (*) mica, (†) amber glass, and (‡) ruby glass.

These figures show that with Edinburgh gas the best result gave an increase of from 4.85 to 21.25-candle power, or as 1 to 4.38. With Arniston cannel gas there was a decided tendency to deposit carbon on the mantle, and there can be no doubt that this burner is not, in its present form, valuable for high quality gas from first-class cannels or oil. The greatest increase was from 7.12 to 23.20-candles, or as 1 to 3.25. With oil gas, there was a rapid deposition of carbon, and the mantle became rapidly useless. The results gave an increase of from 12 to 18.63 candles, or as 1 to 1.55. With poor quality gas the increase was most marked, being from 2.80 to 13.22 candles, or as 1 to 4.72.

Tests were also made with mica and colored chimneys, with the following results:

	Candle Power.
Clear glass, 1 cubic foot.....	12.81
Mica " "	12.81
Amber glass " "	12.18
Ruby glass " "	9.06

The colors of the chimney glasses are by no means equal, and the results must, therefore, vary widely.

I have also tested a burner made specially for oil gas, and have obtained the following results:

Welsbach Oil Gas Burner (no Regulator, White Glass Chimney.)

Cubic Feet of Gas Consumed.	Pressure of Gas on Burner.	Candle Power Found.	Candle Power per Cubic Foot of Gas Burned.	Remarks.
1.5	6-10ths	13.00	8.66	No carbon deposited.
1.7	8-10ths	24.00	14.11	"
1.8	9-10ths	30.00	16.66	"
2.8	20-10ths	78.87	28.16	Roaring.
3.0	25-10ths	73.93	24.64	Roaring explosively. No carbon deposit on the mantle.

Note.—Oil gas No. 2 employed. Candle power in ordinary burners equals 11.32 candles per cubic foot of gas consumed.

These results show that the greatest increase was obtained when burning 1.8 cubic feet of gas at 9-10ths pressure, and was equal to 16.66-candle power per cubic foot, or as 1 to 1.47. The last two experiments are valueless, as the rate of combustion was much too great and too near the explosive point. The results are not nearly so satisfactory as in the case of ordinary gas, as the improvement is only as 1 to 1.47, while the ordinary enriching value (from 60 to 96 candles) is equal to 1 to 1.6.

In April of the present year, Mr. Penman, C.E., of this city, placed in my hands an adaptation of the Welsbach burner, which he considered gave a clearer and brighter light than the usual apparatus. He had been experimenting on the use of the Welsbach light for lantern and photographic enlargements. The speciality of the burner consists in the adaptation outside the mantle of a semicircular attachment, by means of which a small series of oxygen jets are allowed to impinge on the incandescent mantle. The burner gave with Edinburgh gas 12.39 candles, or an increase of light equal to 7.54 candles per cubic foot. When oxygen was introduced, the light immediately rose to 18.81 candles, or taking the gas as 1, then without oxygen the flame was equal to 2.55, and with oxygen to 3.87 candles. I also tested the other qualities of gas with the addition of the oxygen, and the figures are most satisfactory. The best results were obtained with oil gas, in which tests the high figure of 67.64-candle power for each cubic foot of gas consumed was registered. This is equal to an increase of from 12 to 67.64 candles, or as 1 to 5.63, and is equal to 338.20-candle power per 5 cubic feet of oil gas, or 98.20 candles higher in illuminating value than acetylene (240-candle power). The tests with oxygen are proceeding, and I hope, with the addition of a complete outside ring, to increase even this high luminosity. The quantity of oxygen has not yet been accurately determined, but the amount is very small.

I also made some experiments with pure hydrogen, but the burner is not at present adapted to the gas. The tests are proceeding.

Welsbach "C" Burner with Penman Attachment.

Gas Used, and Value per Cubic Foot.	Cubic Feet of Gas Consumed.	Pressure on Burner.	Chimney Used.	Candle Power Found.	Candle Power per Cubic Foot of Gas Burned.	
Edinburgh 4.85 c. p...	.....	10-10ths	Mica	....	12.39	
Edinburgh and oxygen	.....	10-10ths	Mica	....	18.81	
Arniston, 7.12 c. p....	2.20	10-10ths	White glass	41.00	18.63	
	2.35	13-10ths	"	42.00	17.87	
Arniston and oxygen..	2.20	10-10ths	"	58.00	26.36	
	2.35	13-10ths	"	72.00	30.63	
Oil gas, 12 c. p.....	2.40	10-10ths	"	39.00	16.25	(*a*)
Oil gas and oxygen ...	2.40	10-10ths	"	104.32	43.46	(*b*)
	1.65	6-10ths	"	111.61	67.64	(*c*)
Hydrogen.....	5.00	24-10ths	Mica	20.00	4.00	(*d*)
Oil gas and hydrogen.	4.90	10-10ths	White glass	40.00	8.16	
Oil gas and hydrogen with oxygen.....	10.50	10-10ths	"	14.00	1.33	
	4.20	10-10ths	"	42.00	10.00	
	6.00	20-10ths	"	77.62	12.93	
	6.20	25-10ths	"	75.50	12.17	

Remarks.—(*a*) Gas not thoroughly consumed, and carbon deposited on mantle. (*b*) Carbon on mantle. (*c*) Carbon all consumed. (*d*) Burner not suitable.

The table given above also includes some results obtained with a mixture of 10 parts of pure hydrogen and 1 part of oil gas. The introduction of even this small proportion of oil gas gave a luminosity of 8.16 candles per cubic foot, or 40.80 candles for 5 cubic feet; and the further addition of oxygen by the Penman ring increased this in one experiment to 12.93 candles per cubic foot. I propose to make further tests on these lines also.

The following table gives the results obtained with Edinburgh gas when consumed from various burners:

5 cubic feet are equal to—	Candle Power.
Bray No. 8	25.00
Bray "Special" No. 8	29.43
Bray adjustable " ⅜	21.72
" " ½	26.66
" " ⅝	28.37
" " ¾	30.39
" " ⅞	36.16
" " 1	36.76
Milne's old regulator	36.87
Spon's deflector and No. 7 Bray	28.00
Noleton duplex (No. 0 Bray)	32.35
Parkinson regulator and No. 7 Bray	18.12
Peebles regulator No. ⅜	23.75
" " ½	25.00
" " ⅝	23.75
" " ¾	28.57
" street burner	19.41
Welsbach "S" burner	53.30
" "C" "	61.95

I show you, in conclusion, an interesting relic which dates from 1868. During that year my father (Dr. Stevenson Macadam) experimented at the instance of an Edinburgh inventor, Mr. Hogg, with platinum cones, and here I have two of these cones. They are not unlike the earth films used in the Welsbach lamp, and show how near Hogg came to the principle of these valuable patents. I understand he took out provisional protection, but did not continue further.

Discussion.

Mr. Lewis T. Wright said the paper touched upon some points to which he had given considerable attention in years gone by. They must all admit that the little apparatus of Professor Smithells, for dividing the Bunsen flame into two portions, was very ingenious, but he (Mr. Wright) must be allowed to say that the first description of the division of the Bunsen flame into two parts—viz., the primary and secondary—was made by himself in 1887 in a paper he communicated to the Royal Society. The matter received very little attention at the time, and in 1892, something by a German chemist, who was working on somewhat similar lines, was published, and Professor Smithells (who was also working in the same direction) immediately published his results. He (Mr. Wright) believed that the first description of the division of the flame was in his own paper in 1887; but as the matter then appeared to him to be of no general interest he hardly ventilated it. Reference had been made in the paper to some analyses carried out by Professor Smithells, who found in the products of combustion of the inner and slower flame a small proportion of hydrocarbons remaining unconsumed in the primary flame, among which was a certain quantity of acetylene. In his own work, he (Mr. Wright) undoubtedly discovered some small traces of hydrocarbons, which he could not describe as being acetylene (because the quantity was so small), but they certainly were of an acetylene character. The total quantity of hydrocarbons he found in the lower flame was only .2 per cent.—too small, in fact, to enable one to test it definitely and say that it was acetylene. The results brought forward by Professor Macadam as to the effects produced by the Welsbach lamp with various qualities of gas were very important, and certainly called for further investigation. It would be seen that different duties could be obtained from the same gas with the same burner according to the quantity of gas consumed, so that it was evident that the efficiency of the Welsbach burner was largely a question of consumption. In an incandescent burner a solid body was raised to high temperature, and the degree to which it was raised depended very much on the conditions of combustion in the burner—on the quantity of gas consumed and the manner in which it was consumed. With 5-10ths pressure it gave 4 candles per cubic foot, and with 20-10ths the duty was nearly 13 candles. He should like to know whether the burners used with the oil and other rich gases were specially designed for high-quality gas, since if carbon had been deposited on them it was rather a proof that the Bunsen principle had not been fully carried out. It might be that the burner was specially designed for a low quality of gas, and so was incapable of properly consuming a richer quality. The adjustment of the air supply was an important point in all Bunsen burners, and with gas of a very high quality a much larger air supply would, of course, be required.

Mr. C. S. Ellery (Bath) asked how Professor Macadam tested the illuminating power—against what standard.

Dr. Stevenson Macadam did not propose to say anything on the main points which his son had brought before the meeting, but on the last point referred to—viz., the platinum cones which were introduced by Mr. Hogg in 1868—he thought a good deal of the principle of the Welsbach burner had been anticipated. It happened that the subject was brought before the Royal Scottish Society of Arts in Edinburgh, and a committee was appointed to investigate the matter. He was a member of the committee and conducted the various experiments. They were quite satisfied at the time that it was an important improvement in regard to getting an increased illuminating power from coal gas, but certain circumstances prevented the inventor going on with the inquiry. If the members would look at the cones exhibited, they would recognize that they indicated the principle which had since been so successfully worked out in the Welsbach light.

Mr. John West (Manchester) said he had been making some experiments with incandescent gas burners, testing them with various qualities of gas. He tested them with 15-candle gas at Plymouth, and with 20-candle gas at Manchester, and he found about the same result with both—a light equal to 12 candles per foot, or 60 candles per 5 cubic feet of gas consumed. The experiments made by Dr. Macadam with Edinburgh gas seemed to tell about the same story. The Edinburgh gas, which was of 24.26-candle power, gave a light, when consuming 5 cubic feet of gas from an incandescent burner, of 61.70 candles. It had often struck him (Mr. West) that if they could get such an advantage with the incandescent burner using a low quality of gas, there was very little advantage in making rich gas as in Scotland. Of course their Scotch friends would not agree with him, but it appeared to him that the incandescent burner was of the greatest benefit to those in the South, where cannel was not so plentiful and cheap as in Scotland. When they were told that, for a consumption of about 2½ cubic feet of common gas, the luminosity should be increased from 13 candles to about 60 candles, what was the advantage of using so much cannel? The President had pointed out in his address that the proper thing to do was to educate the public. There was a great deal in this statement, and some of them had been for many years trying to do so. But until the introduction of the incandescent burner they could not possibly get out all the light which was in the gas without consuming it at the rate of about 5 cubic feet per hour. That was the reason why Edinburgh was so poorly lighted a city before the electric light was introduced—they did not allow sufficient gas in the public lamps to bring about proper combustion and get all the light from the gas which it contained. He should like to ask Dr. Macadam if he did not think it would be wise to sell the gas as it was produced from coal without using an expensive cannel, simply employing an incandescent burner to increase the light. In the South there was great difficulty in raising gas from 14 to 15 candles. The extra candle necessitated an enricher—either the addition of a percentage of cannel or something similar—in order to attain the standard fixed by the Legislature. If they could get out of this difficulty in the South it would be a very good thing. He did not know whether or not the Legislature would allow them to use an incandescent burner for testing purposes, but, if so, they could easily get over the difficulty. It seemed to him there was great waste going on in Scotch towns, where rich gas was being supplied, through the use of small and imperfect burners being so generally adopted.

Professor Ivison Macadam said he had not made any claim for Professor Smithells to the discovery of the two cones, but he did claim the apparatus shown for demonstrating the fact. He certainly did not desire to ignore any work done by Mr. Wright. Professor Smithells got the small percentage of hydrocarbons tested, and it proved the presence of acetylene. He quite agreed that at present the duty obtained from a Welsbach burner depended very much on the quantity of gas which passed through it. His experiments had been conducted with a view of showing at what pressure, and with what amount of gas, one could get the best return. The Welsbach Company acknowledged, in fact, that the burners were not altogether suited for various pressures, because they supplied regulators for the purpose and told their customers that the gas consumption ought to be about 3½ cubic feet per hour in one burner, 1¾ to 2 cubic feet in another, 2 cubic feet in a third, and 3½ cubic feet in another. His results were intended to show what proportion of illuminating value could be got from various gases, so as to

lead up to the question of what proportion of each quality should be burned to give the maximum amount of light. The "C" Welsbach burner was the one supplied for ordinary Edinburgh gas, but in his paper there was a table giving the results from a special oil gas burner which had been placed in his hands. There was no great difference in it except in the number of openings leading to the Bunsen and through which the gas issued, and also in the air space, which was specially regulated. With this burner the illuminating value of the gas was decidedly higher. His experiment showed that when gas was above 24-candle power it was not advantageous to employ the ordinary form of Welsbach "C" burner, but a special burner should be asked for, having a smaller opening for gas and a larger opening for air. The standard used in the testings was the ordinary candle. Some gentlemen might possibly object to this standard, and, of course, he was aware of its imperfections. But still the tests were comparable. What Mr. West had said about the Manchester and Plymouth gas seemed to confirm his own (the speaker's) results. He did not think there was much difference in the value of a burner until the gas was above 24 candles, and then such richer gases were certainly wasted in the ordinary Welsbach burner—15 or 16-candle power gas was quite good enough. He perfectly understood why Mr. West should not desire to make a rich gas. One great difficulty which would always stand in the way of the Welsbach burner was its cost, and another objection many people had was that if they had a 5-light cluster, and put only two Welsbach lights on it—which were quite sufficient—the apparatus looked lopsided. The initial cost of the burner, however, was the principal objection, though anyone burning much gas would soon save that cost by the reduction in his gas bill.

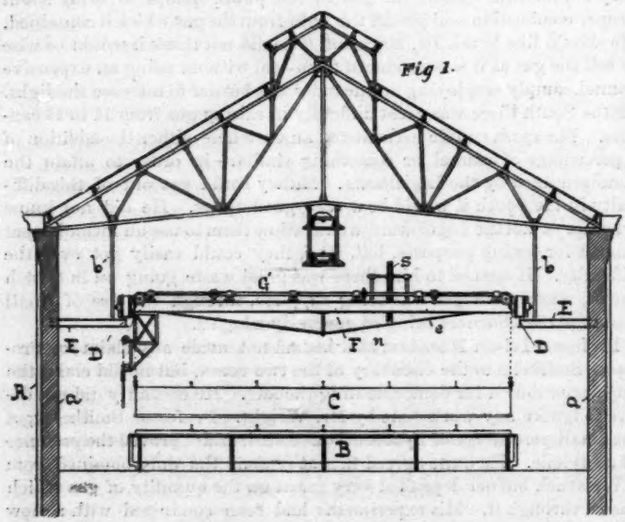
Mayer's Apparatus for Manipulating the Lids of Purifying Boxes.

On May 21st, 1895, U. S. Letters Patent (No. 539,628) were issued to Mr. Frederick Mayer, of Baltimore, Md., for an improved method of handling the lids of purifying boxes. Using the words of the specification:

Figure 1 is a transverse section of a purifier house, together with its contents, which include the apparatus embodying the present invention. Fig. 2 is a longitudinal sectional view of a part of the purifier house, together with a portion of the apparatus shown in Fig. 1. Fig. 3 is an enlarged plan view of the raising and shifting apparatus alone. Fig. 4 is a still enlarged sectional view of a carriage and purifier lid, shown in Fig. 2. Fig. 5 is an enlarged view of parts of Fig. 3, and Fig. 6 an end view of Fig. 5.

Referring now to the drawings, *A* is the purifier house and *B B* are the purifier boxes. *C C* are the lids of the said boxes, which have to be raised and shifted in position.

Fig 1.

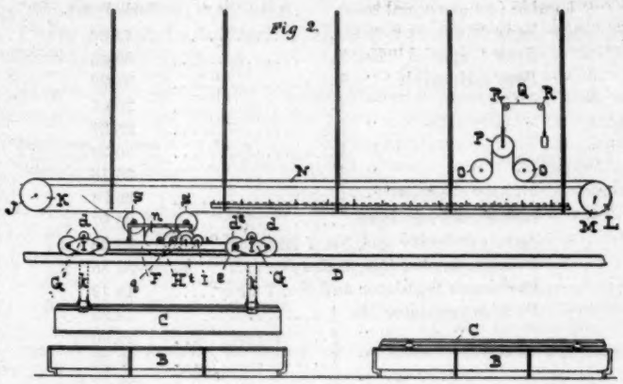


D D are the track rails, consisting of I-bars, which extend longitudinally of the house *A*. These track rails are supported by other I-bars *E*, which project from the side walls *a* of the building, and also by rods *b* pendent from the roof truss.

F is a carriage on the rails *D*, adapted to be moved longitudinally thereof. The carriage is formed of bars *c*, which united constitute the carriage frame, and it has truck wheels *d* and *d*² which sustain it on the track rails. The truck wheels *d*² are secured to the shaft *e*, which is revolved to move the carriage longitudinally of the track rails *D*. The other truck wheels are idlers and merely support the carriage.

G and *G*¹ are spindles, one at each end of the carriage, provided with a right-hand thread *f* at one end, and a left-hand thread *g* at the other, as shown particularly in Fig. 3. On each threaded portion of the spindles is a nut *h*, having eye-bolts *j*, to which chains *k* are fastened. These chains lead over pulleys *m* and may be attached to the lid *C* of

Fig 2.



a purifier box *B*. From this it will be seen that a lid may be raised by turning the spindles in one direction and lowered by a reverse turning.

H is a shaft having a rope sheave *n* and a pinion *o*. This pinion is in engagement with a gear wheel *p* on a shaft *q*, which shaft carries a pinion *r* in mesh with a gear wheel *s* on a shaft *t*. *I* is another shaft driven from the shaft *t* by means of gears *u* and *v*, which are of equal size. The shaft *I* carries two sprocket wheels *a*¹ and *b*¹. The sprocket wheel *b*¹ is connected to a similar sprocket wheel *c*¹, which is loose on the plain or unthreaded portion of the spindle *G*, by means of a chain belt *d*¹. On the said spindle is a similar tight sprocket *e*¹, which is connected to a similar sprocket *f*¹, which is tight on the other threaded spindle *G*¹, by a chain belt *g*¹. The shaft *t* has also a sprocket wheel *h*¹, larger than the one *b*¹ on the shaft *I*, and it is connected by a chain belt to a sprocket wheel *i*¹, which corresponds in size with the one *c*¹. The said shaft *t* has also another sprocket wheel *j*¹, about the same diameter as the one *a*¹ on the shaft *I*. The sprocket *j*¹ drives, by means of a chain belt *m*¹, a loose sprocket wheel *k*¹ on the shaft *e*, to which the driving truck wheels *d*² are fastened.

The sprocket wheel *a*¹, before alluded to, drives by means of a chain belt *n*¹ a loose sprocket *o*¹ on the shaft *e*.

A double-faced sliding-clutch member *p*¹ is fastened to the spindle *G*, and the loose sprockets *c*¹ and *i*¹ have clutch teeth on their opposing faces. The clutch member can thus be made to engage with either sprocket by moving it longitudinally of the spindle. When the clutch member *p*¹ is brought into engagement with the teeth of the sprocket wheel *c*¹ the spindle is turned in the direction required to bring toward each other the nuts *h*, and the chains *k* being tightened, the purifier box lid *C*, to which they are attached, is elevated; but when the said clutch member *p*¹ is made to interlock with the teeth of the sprocket *i*¹, and leaves the one *c*¹, the direction of revolution of the spindle *G* is reversed and the lid lowered, and the lid is lowered faster than it was raised, in view of the sprocket *h*¹ being larger than the one *b*¹. Another double-faced sliding-clutch member *q*¹ tight on the shaft *e* may be interlocked with either of the loose sprockets *k*¹ or *o*¹, the said sprockets having teeth similar to the ones on the clutch. By this gearing the lids of the purifier boxes may be either raised or lowered, and the raised lid which is suspended from the carriage moved longitudinally of the building.

To give movement to the shaft *H*, a main driving shaft *J*, which is at one end of the building and receives its motion from any source, is provided with a rope pulley *K*. A similar pulley *L*, on a shaft *M* at the other end of the building, is connected to the pulley *K* by an endless rope *N*. In order that the rope *N* may be always tight and have a uniform tension, the upper section of the rope runs around the sheaves *O* and *P*, the latter being suspended by a weighted cord *Q*, which runs over the small pulleys *R*. The lower section of the endless rope *N* passes over pulleys *S S*, shown in Fig. 3, on the carriage *F*, and under the sheave *n*, which is on the shaft *H*, having the first gear wheel of the train described. Now it will be seen that by moving the endless rope *N* the train of gearing described is set in motion, and when the clutch *q*¹ is brought into engagement with either of the sprockets *k*¹ or *o*¹, the

carriage is moved longitudinally of the track rails and of the building. The clutch member q^1 has a shifting lever a^3 fulcrumed at b^3 to the carriage, and at its outer end is provided with eyes c^3, to which rods and chains e^3 are attached. These rods and chains are connected at the other end to a T-hand lever f^3, pivoted at g^3, and provided with a guide h^3. The said hand lever and the guide have holes i^3 through which a pin j^3 may be inserted to hold the hand lever in any one of its three positions. By moving the handle f^3 the clutch member q^1 may be brought into engagement with either of the sprockets k^1 or o^1, and the carriage thereby made to traverse the track rails D in either direction. The clutch member p^1 has a lever k^3 fulcrumed at m^3 to a part of the carriage, having eyes n^3 which are united to a T-hand lever o^3 by means of rods and chains p^3. The operation of this hand lever is the same as the one f^3, except that it moves a different clutch member and one which may be connected to either of the sprocket wheels c^1 or i^1 on the spindle G. By this arrangement the chains k are practically lengthened and shortened so as to lower or elevate a purifier box lid when attached thereto, as shown particularly in Fig. 4.

When the lid of a purifier box is to be raised and then carried away from the box, so that the same may be filled or emptied of its contents, the hand lever o^3 is moved in the direction indicated by the arrow and held in the new position until the ends of the chains k can be coupled to the box lid. The said hand lever is then moved to the other extreme position which effects the elevation of the lid, and this elevation continued until the lid is raised to the desired height. The hand lever is then placed in a central position which disconnects the clutch operated by it from both adjacent sprocket wheels, and the movement of the spindle is stopped. The hand lever f^3 is then moved in such direction as will effect the transportation of the lid to the desired part of the building, and when this place is reached, the lid may be either left suspended or lowered as required. To stop the longitudinal movement of the carriage the lever f^3 is placed in a central position.

After the box has been filled with new material the operation described is reversed by a proper manipulation of the hand levers.

Fig 3.

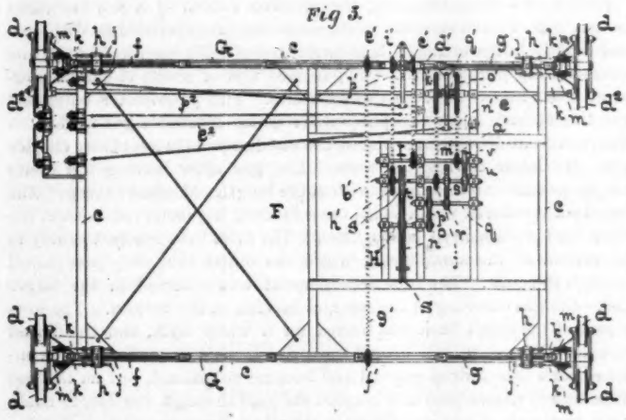
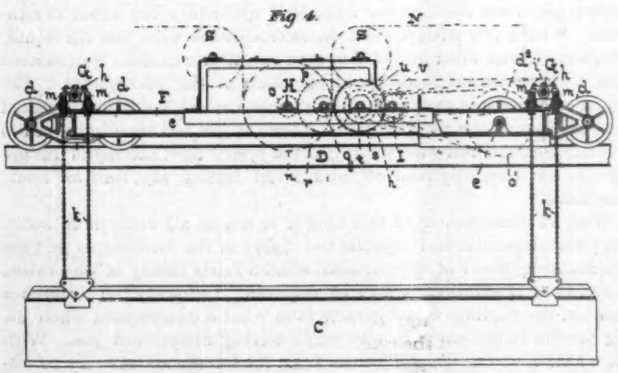


Fig 4.



It will be understood that the rope N produces all the operations described in connection with the purifier box lid by merely moving the hand levers as described.

I claim as my invention—

In an apparatus for raising, lowering and shifting the lids of purifier boxes in gas works, the combination of an overhead track, a carriage adapted to traverse the track, a pair of revoluble spindles supported by the carriage, each spindle having a right hand thread at one end and a left hand thread at the other, a nut on each threaded portion of the

Fig 5.

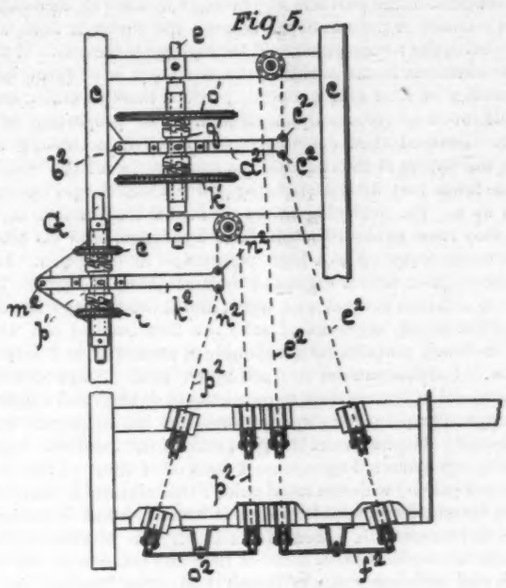
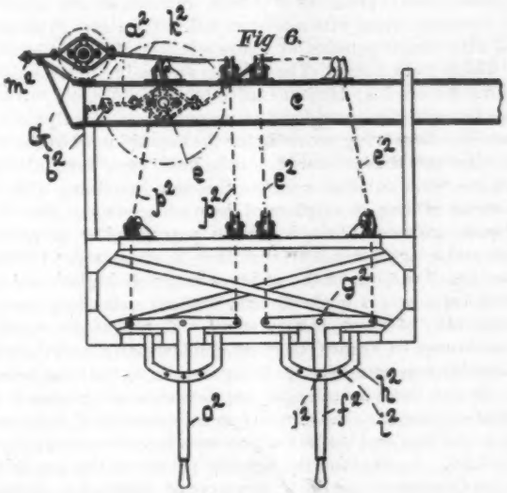


Fig 6.



spindles having hoisting chains adapted for attachment to a purifier lid, gearing to effect a joint movement of the two spindles in either direction of revolution, to lift or lower the purifier box lid, other gearing to effect the movement of the carriage longitudinally of the overhead track, and an endless moving rope to give motion to the said gearing, substantially as specified.

Manufacture of Cyanides.

Mr. T. R. Haller gives the following account of recent developments in the manufacture of cyanides and ferrocyanides: The old process for making cyanides of potassium was by calcining dried yellow prussiate of potash, leaching and crystalizing; $(CN)_6FeK_4 = 4KCN + C_2Fe + N_2$. A third of the cyanogen was thus lost, and Liebig recommended that dry carbonate of potash should be added; then $K_4Fe(CN)_6 + K_2CO_3 = 6KCN + CO_2 + FeO$. This process was largely adopted; but the cyanide contained carbonate of potash and also cyanate, due to the oxidizing action of the FeO produced. Messrs. Rössler & Hasslacher, of New York, use sodium. Sodium is of less use since aluminum has been made electrolytically; the manufacture of antipyrin and of binoxide of sodium do not make up for the diminished demand. The sodium is made to act on powdered and dried yellow prussiate of potash; $K_4Fe(CN)_6 + Na_2 = Fe + (KCN)_4(NaCN)_2$. The potassium-sodium cyanide thus produced is sold as "cyanide of potassium," and has a somewhat higher percentage of cyanogen than KCN itself would have. Prussiate of

potash was made some ten years ago exclusively by the calcination process—leather, etc., and carbonate of potash; but during recent years great quantities of it are being made from the nitrogen of coal by means of gas works residues. From 1½ to 2 per cent. of the nitrogen of the coal is retained in the purifiers as cyanogen in some of its compounds. It is not retained in the scrubbers, because the carbonic acid which is present drives the hydrocyanic acid forward with the gas. If there be but little ammonia in the purifiers, the tendency is to form insoluble ferrocyanides of iron and ammonia; when there is much ammonia the tendency is to form sulphocyanides. The proportion of ferrocyanides obtained thus depends upon efficient scrubbing as well as upon the nature of the coal and the temperature of the distillation, and these latter vary with the lighting power which the gas manager has to work up to. The purifying oxides are sold to the prussiate makers as soon as they cease to absorb sulphureted hydrogen, and no attempt is made to bring them up to a high percentage in cyanogen. In some works the sulphur is first extracted by bisulphide of carbon, but the sulphur so obtained is black and tarry, and it hardly pays to purify it. In other works the ammoniacal salts are first leached out with hot water; the leach contains sulphocyanide of ammonia and sulphate of ammonia. Sulphocyanides are not much used. Sulphocyanides of aluminum and of tin are used as mordants in dyeing, and sulphocyanide of copper as a paint for ships' bottoms, but the aggregate quantity used is small. The hot water does not extract the insoluble ferrocyanides; these are extracted by means of soda or of lime. Lime is mixed (Kunheim's patent) with the dried oxide; the mixture is steam-heated in closed vessels, ferrocyanide of lime is formed, which is leached out; chloride of potassium is added to the leach; the mixture is boiled to precipitate the double ferrocyanide of lime and potassium; the precipitate is treated with carbonate of potash, and, after filtering, the liquor is crystallized to form prussiate of potash. Sometimes this liquor is precipitated (Prussian blue) with a ferrous salt. Then the Prussian blue is treated with caustic potash and a pure solution of yellow prussiate is formed, which is crystalized. The sulphur remaining in the oxide after this treatment is not found remunerative to extract directly, on account of the tar, but it is often used for the manufacture of sulphuric acid, large dust chambers being provided for the deposition of oxide of iron dust. In that case the tar, sawdust, coke-dust, etc., burn along with the sulphur. Some sulphur is wasted through remaining with the inevitable excess of lime, as sulphate of lime, consequently the sulphurous acid gases are more dilute than when pure sulphur or pyrites are employed, and a larger range of chambers is necessary. In England the percentage of sulphur in the residues is much higher, and a great deal of sulphuric acid is made directly without extracting ferrocyanides, the quantity of which is very small. Ferrocyanides reach their highest percentage in France, Belgium and Germany, and the whole of the residues in these countries are being worked up for these ferrocyanides. In France there is no longer any ferrocyanide prepared by the old calcination process. In Germany some hundreds of tons are still made by it. In England the newer processes have been tried, but have not taken hold. In England the lighting power of the gas is higher than on the Continent, and the temperature of distillation correspondingly lower; the yield of ferrocyanides is therefore little or none, and since bisulphide of carbon has to be extracted, as well as sulphureted hydrogen, purification by lime is much resorted to. In Austria the calcination process for making prussiate is in use, for the materials are cheap and the gas works residues are poor in ferrocyanogen. In the United States there are several prussiate works which all use the old process, for the gas industry has taken a different course here from the European.

Ferrocyanide of sodium can only be made with advantage by the gas works process; but it is little used, for it makes a greenish kind of Prussian blue and produces dubious tints in the dyeing of silk black.

The Strassfurt Chemical Works produces cyanides made (German patents 38,012 of 1886, and 51,562 of 1889) by the action of ammonia at a red heat on a mixture of broken wood-charcoal and alkaline carbonate. The retort charge is first heat-dried, and then the ammonia gas is led into it at a point where the temperature passes from bright red to dark red. A slow current of ammonia is kept up, and the products are withdrawn and leached systematically until the leach has a specific gravity of 1.4, then carbonate of potash is added. The greater part of the cyanide deposits either at once or else upon cooling. The mother liquor is treated with iron in order to transform the remaining cyanide into ferrocyanide of potassium, and from the last mother liquors, to which sulphate of ammonia is added, urea is extracted. This process, though it has been worked for some years, does not appear to have been very profitable, for the firm which has the monopoly of it limits itself to a small output, and does not seem disposed to extend its operations.

Notes on Experiments with Liquid Gas Enrichers.

In our issue for May 27, 1895, p. 774, we noted that Mr. T. Stenhouse (Gas Analyst to the Rochdale, England, Corporation) had read a paper on the subject named in the heading before the Manchester Section of the Society of Chemical Industry. The full text of the paper, which subsequently appeared in the *Journal* of the Society, is as follows:

During the last few years many gas managers, instead of using cannel coal, have raised the quality of the gas obtained from ordinary coal to the required standard by using liquid enrichers. These have been vaporized by steam in various kinds of carbureters. Generally the gas is improved two or three candles in this way. There is, however, a great difference in the few published statements respecting the value of the various hydrocarbons commonly in use—especially of carburine and benzole—probably there is as great a difference between the privately circulated results believed to have been obtained at various gas works where enrichers of this class are employed. Dr. Bunte, for instance, makes the rather wide statement that between 7 and 9 grains of benzol vapor will improve one cubic foot of gas between 4 and 5 candles. This is equal to an improvement of one candle in over 30,000 cubic feet of gas by one gallon of benzol.

Mr. Hunt, of Birmingham, has stated that one gallon of benzol enriches 9,500 cubic feet one candle, and that one gallon of carburine improves 2,800 cubic feet to the same extent.

In an interview with Mr. William Young, of Peebles, a report of which appears in the *Gas World* for January 26th, 1895, this gentleman credited a gallon of benzol with an enrichment value of only 4,500 candles, and carburine with being only one-fourth as effective.

These statements are so greatly at variance that a gas manager, wishing to select some enricher of this kind for his gas, must be not a little perplexed, and scarcely able to calculate what the cost will be.

Of course it is quite possible that gases of the same illuminating power may so differ in composition that no particular enricher will have exactly the same improvement effect upon them. This, however, cannot account for the enormous differences just noticed.

With a view of ascertaining the relative values of a few enrichers for coal gas, I have recently made some careful experiments with several liquids, but principally with carburine of 0.680 specific gravity, and commercially pure benzol. The gas used was of about 16-candle power, and was improved from 1 to 2 candles. The photometer employed was the 60-inch open-bar photometer at the Rochdale gas works. A Methven 2-candle screen replaced the candles so as to avoid any trouble with the latter during the tests. The gas after leaving the meter was by-passed into two flasks with short lengths of glass tubing. The first flask it entered was a small one, holding a quarter of a liter, the other had a capacity of two liters. The inlet tube reached nearly to the bottom of the small flask, while the outlet tube only just passed through the cork. The tube arrangement was reversed in the larger flask—the gas entering at the top and leaving at the bottom. The lower part of the small flask was heated on a water bath, and the liquid enricher allowed to fall drop by drop. In this way the gas was enriched each time a drop entered and became volatilized, but as the gas immediately passed into and became diffused through the larger flask, there were only slight variations in the illuminating power of the improved gas when the enricher was added uniformly for about 15 minutes. With a few trials it was soon ascertained at what rate the liquid, whatever it was, must be added to give one or two candles enrichment and allow accurate readings to be taken at the photometer. The liquid enricher was measured from a burette with glass tap, and passed into the flask at the required rate. After the gas had been improved to a suitable extent and was burning at the proper rate, the liquid in the burette was carefully read off, and a test, lasting, say, half an hour, was made.

With an arrangement of this kind it is not at all difficult to watch the photometer disc and regulate the supply of the enricher, so that the illuminating power of the gas shall remain fairly steady at one value, say at 18 or 19 candles, as may be required. Certainly the difference between the readings is not greater than what is experienced when using candles in the ordinary way while testing unenriched gas. With the addition of one drop of benzol from the burette about every 20 seconds, one can get an improvement of about 2 candles when the gas is burning at 5 cubic feet per hour. Between two and three times as much carburine is required to give the same improvement.

Added in this way, practically all the liquor is vaporized under the influence of heat and the stream of gas playing over the bottom of the small flask. Even with enrichers containing small quantities of dense hydrocarbons there is a mere stain left in the flask after an hour's test.

Under these circumstances one may safely rely on obtaining the full duty from the liquid under examination, as it is practically all turned into vapor and carried directly into the flame the illuminating power of which is being determined. As the flame is never more than equal to 18 or 19 candles in these tests, the gas is never saturated with the added vapor, and consequently will have no tendency to deposit anything either in the larger flask or in the short length of tubing leading to the argand burner. It may here be remarked that at Rochdale, where carburine has been employed as an enricher during the last two or three years, Mr. T. Banbury Ball, engineer and manager of the gas works, has not found that any of the liquid has condensed in any of the siphon boxes attached to the mains, notwithstanding the severe frost of last winter.

Working in the way just described, the following results have been obtained with the respective liquids:

	Gas Enriched 1 Candle by 1 Gal. of the Liquid.
Benzol (chemically pure)	13,300 ft.
Benzol (90°)	12,500 "
Carburine (0.680 specific gravity)	5,700 "
Common petroleum spirit of 0.700 sp. gr.	4,300 "

Of these liquids the two important ones are commercially pure benzol and carburine or light petroleum spirit. Their composition is well understood. As the specific gravity shows, a gallon of the former contains about 2 pounds more real matter than the latter. Besides that, the molecular structure of the benzol molecule is such that, of all the liquid hydrocarbons known, it is the one which may be expected to break up most readily into that wonderful acetylene of which we have heard so much lately, and which, according to some authorities, puts everything else in the shade as a light producer.

Benzol is a liquid which is being produced more plentifully every year from the gas and tar obtained from coke ovens. It was recently estimated that 50,000,000 gallons of benzol could be obtained from the 30,000,000 tons of coal annually coked in Great Britain, if the coking were done in closed ovens. There is, therefore, every probability that this most useful liquid will be available in the near future in greater quantities. It is already a rival of carburine, and may soon supersede it altogether for enriching gas of 15 or 16-candle power. So long as benzol can be purchased at 25 cents per gallon, it is, in my opinion, decidedly preferable to carburine, even at the lowest price at which the latter has yet been sold. Volume for volume it is about 2¼ times as efficient as a gas enricher, and there is less loss and danger from evaporation during transit. The temperature at which benzol volatilizes is also a convenient one, as ordinary steam heat is all that is required. The amount of benzol vapor which common coal gas can permanently retain—viz., over 50 grains per cubic foot at 0° C.—is greater by far than anything required to enrich low quality gas to any reasonable extent. If used in a rational way, there is therefore no need to fear that the added benzol will be condensed and deposited in the gas mains.

American Portland Cement.

In addressing the Master Builders' Exchange, of Philadelphia, on this subject, Mr. William G. Hartranft said:

The remains of great engineering and architectural works in Egypt and parts of Asia and Europe prove that ancient and extinct civilization was familiar with the use of cement. Mr. Henry Reid says: "These remains, of a varied and interesting character, even now show us how much of their stability and permanence is due to the quality of the cementing agents by which the building materials were put together." The experiments conducted by Mr. John Smeaton in the years 1756 and 1757 for a reliable mortar for building the Eddystone lighthouse, and the experiments carried on by Dobbs, John, Vicat, St. Ledger, Palsley and Frost in the early part of this century, and the taking out of patents by Joseph Aspin, of Leeds, England, in the year 1824, for the manufacture of what he called "Portland cement," show that the men of the eighteenth century did not possess as much knowledge of hydraulic cement as the men of ancient times.

Mr. Aspin's Portland cement, so called because the artificial stone made from it resembled the Portland building stone of England, was manufactured under the following patent: "My method of making a cement or artificial stone for stuccoing, buildings, water works, cisterns, or any other purpose to which it may be applicable (and which I call Portland cement) is as follows: I take a specific quantity of limestone, such as that generally used for making or repairing roads, and I take it from the roads, after it it is reduced to a puddle or powder, but if I cannot procure a sufficient quantity of the above from the roads I obtain the limestone itself and I cause the puddle or powder or the limestone, as the case may be, to be calcined. I then take a specific quantity of argillaceous earth or clay and mix them with water to a state approaching impalpability, either by manual labor or machinery. After this proceeding I put the above mixture into a slip pan for evaporation, either by heat of the sun or by submitting it to the action of fire, or steam conveyed in flue pipes under or near the pan, until the water is entirely evaporated. Then I break up said mixture into suitable lumps and calcine them into a furnace similar to a lime kiln, until the carbonic acid is entirely expelled. The mixture so calcined is to be ground, beaten or rolled to a fine powder, and is then in a fit state for making cement or artificial stone. This powder is to be mixed with sufficient quantity of water to bring it into the consistency of mortar and thus applied to the purposes wanted."

That this process of late years has not always been honestly followed in England will be seen by a letter which I will read, which was sent out by the attorneys of one of the largest cement manufacturers in England to the other manufacturers:

"London, October 26, 1894.

"Dear Sirs: We are desired to call your attention to the following circumstances seriously affecting the trade in which you are engaged. It is becoming notorious that several manufacturers of English Portland cement are largely adulterating their manufacture by the mixture of Kentish ragstone, other stone, furnace or oven ashes, disused or exhausted firebricks, or other inert material, and so bringing disrepute on the good name English Portland cement has hitherto borne in comparison for quality with cement of foreign manufacture. Such practices are so detrimental to the best interests of the cement trade, both by the discredit which is thereby attached to English manufacturers and the unfair competition in prices thereby rendered possible, that it is now proposed to form an association of English cement manufacturers for the purpose of dealing with and if possible putting a stop to a practice so unprincipled and disreputable and so calculated to perpetuate an injury to the trade. We are instructed to inquire if you would be willing to join an association of cement manufacturers for this purpose, and if so we shall be glad to hear your views on the subject and to know if you would attend a meeting presently to be convened. We are, gentmen, your obedient servants, Renshaw, Kekewick & Smith."

A detailed report can be found of this meeting, which ended without accomplishing any result, in the issue of November 23, 1894, of the London *Fairplay*. The German Association of Cement Manufacturers require that Portland cement shall be made by calcining an intimate mixture of calcareous and argillaceous materials as chief ingredients and subsequently grinding the calcined mixture to the fineness of flour.

Mr. David O. Saylor, the pioneer manufacturer of Portland cement in this country, said: "In order to make Portland cement it requires a homogeneous mixture, containing, in proper proportions, carbonate of lime, alumina, silica and iron. This mixture must be subjected to a heat sufficiently high to produce a vitrified, dense and heavy clinker, and afterwards ground to very fine powder. The induration or setting of Portland cement consists in the formation of a real mineral, of a crystalline rock species, which appear to be analogous to rock zeolites. This fact can be confirmed by microscopic examination of a true Portland cement. The set will be found to consist of translucent and, to some extent, even of transparent crystalline particles of different forms, exactly like those of the zeolites of nature."

It will be seen by the above that the early manufacturers of Portland cement in England, Germany and America were of one mind as to the constituents of a good Portland cement, and with the American's generous and unlimited deposits of the purest cement making rock found in the world, it is not surprising that American cements are of the best quality.

At the present time the bulk of the English cement is manufactured from chalk instead of hard limestone. This chalk is mixed with clay, in the proper proportions, before burning in a large wash mill, and the slurry is then run off and dried, either by artificial means or sun evaporation. The only difference in the burning now than in Aspin's time is that this dried slurry is now burnt to a hard clinker instead of first expelling the carbonic acid gas. Works were started for the manufacture of Portland cement in Germany, France and Belgium soon after the works were established in England. In the former countries it is largely made of an argillaceous limestone or a marl. This material is usually ground and mixed in a dry state, dampening only sufficient to mold into a brick, so as to facilitate the leading of the composition into the kilns.

The Portland cements of Europe did not begin to find their way to this country until about 1865, and from 1865 to 1870 small quantities

were shipped here and sold at from $8 to $10 per barrel. This large price and the increase in demand for this cement attracted the attention of Mr. David O. Saylor, who was then manufacturing at Coplay, Pa., a light, burnt, hydraulic cement, commonly known on this market as Rosendale, and he decided to make a Portland cement, equal to any made in Europe, out of the argillaceous limestone found at Coplay, and which, in the latter part of the year 1874, he succeeded in doing. Although this was 50 years later than the industry was started in Europe the American product at once took first place on large engineering work, where great quantities have been used.

Major General Gilmore, after testing and inspecting the cements at the Centennial Exhibition, said there were 13 brands of foreign and one American Portland cement exhibited, and that the American brand stood among the five best specimens. In 1878 Capt. J. B. Eads selected an American Portland cement with which to build his great work, the concrete Mississippi jetties, using 12,000 barrels alone in this one operation. It is worth noting, while we are reading from time to time in the engineering journals of concrete work in Europe disintegrating under the influence of the salt and waves of the ocean, that these concrete jetties at the mouth of the Mississippi river, which have successfully withstood the action of the salt and waves of the Gulf of Mexico, are made of Portland cement manufactured within 65 miles of Philadelphia. The great concrete docks which the city of New York has been building for the past 18 years have been largely made of American Portland cement.

American Portland cement was also used largely on the big masonry dams and aqueducts of the Croton water supply for New York, in the foundations of the Brooklyn Bridge, in the Hudson river tunnel, the Niagara tunnel, in the foundations of the new Manhattan Life Insurance Company's building, New York City, on the concrete jetties at Sandy Hook, and is now being used by the United States Government on the new post office building at Washington, D. C., and in the concrete sea walls being built at Brooklyn, League Island and Norfolk navy yards. Among the large buildings in Philadelphia built with American Portland cement are, the Drexel Building, the Drexel Institute, the Provident Building, the Girard Building, the Harrison Block, the Pennsylvania Railroad Station, the Philadelphia and Reading Railroad Station, the Odd Fellows' Temple, the Women's Medical College, the Bourse Building, the new Hotel Walton, the last two being still under construction.

With such monuments to the durability of American Portland cement it is almost inconceivable how an engineer or architect can feel justified in drawing his specifications in a manner so as to exclude the American manufacturers from competing for their work; yet there are many men who have charge of the erection of buildings which in the aggregate consume as much Portland cement as the large engineering operations, who do not permit the American Portland cement to be used. If this rejection of a native product for one of foreign manufacture was done after a careful comparison of the quality of the two materials, and the native cement found wanting in any good particular possessed by its foreign rival, the American manufacturer would not complain, but such rejections are simply because it has the misfortune to have been made by American labor and out of lime, silica and alumina found in this country rather than Europe, as comparisons which have been carried out in a large and impartial manner have proven beyond question that the American Portland cements as a class are equal to the foreign cements.

In proof of this I will cite a few instances. In the report of the Engineer Commission of the District of Columbia, for the year ending June 30, 1893, we find there were seven German, two English and five American brands of Portland cement submitted on Government work in Washington and carefully tested by the Commission. The two cements which proved to be the strongest when tested neat and with sand mortar and the finest ground, were both American Portland cements. In the report of the Water Commission of St. Louis for the year ending April, 1894, where 80,000 barrels of Portland cement were recently used, we find tests on 15 brands of Portland cement carried out for two years, and that among the four best brands was one made in this country. In the annual report of the Director of Public Works, of Philadelphia, for the year 1893, we find that two of the strongest and finest cements used were American brands. From over 6,000 tests made by the Survey Department, of Philadelphia, on cements being supplied to city works during the year 1894, we find that the average strength of the American Portland cement in neat and sand mortar was in excess of any of the foreign cements. The different foreign cements figuring in these various reports are the best European brands, many of which cost in this market from 25 to 50 cents per barrel more than the American Portlands, although the latter have proven to be so much superior. With these facts and figures in your possession, the American manufacturer asks the builders and contractors of this country to assist in bringing to the attention of the architects and engineers the fact that in using foreign cement they do not get the best quality, and are wasting their clients' money.

In the year 1894 there were 19 factories in the United States, which make about 700,000 barrels of Portland cement, this amount being but 18 per cent. of what was imported. The largest factories are located in Lehigh County, Pa., in the neighborhood of Coplay. All the factories located in this region make cement under the dry process from an argillaceous limestone. There are several factories in New York State along the Erie Canal, and in Ohio, where marl and clay, or limestone and clay are used. Practically nine-tenths of the Portland cement manufactured in this country is made in the States of Pennsylvania, New York and Ohio. Other States where small quantities are manufactured are Texas, Colorado, Dakota, Oregon, California, and the territory of Utah.

There is plenty of raw material, suitable for making the highest grade of Portland cement, in almost every State in the Union, and with the proper encouragement from our architects, engineers, and builders there is no reason why all the cement needed in this country should not be made at home.

The Arc Light and the Sun.

Prof. A. E. Dolbear, in a communication to the *Cosmopolitan*, says that the temperature of the sun, as estimated by different persons employing different methods, has varied from two or three thousand degrees to several millions. The brilliancy of sunlight makes it extremely difficult to measure its brightness by comparison with ordinary terrestrial standards, but it appears to be not very different from the brightness of a good electric arc lamp. How much energy is radiated by the sun is very well known now, and is reckoned to be about 10,000-horse power per square foot of its surface. At the earth we receive only one-third of a horse power per square foot, and of this about one-third is absorbed by the atmosphere, so out of the 10,000-horse power we get at the surface of the earth but about the fourth of 1-horse power.

A good electric arc can be maintained by the expenditure of six-tenths of a horse power. The brightest part of the arc is a small area within the crater of the positive carbon. The temperature of this brightest part has been found to be constant with a value of 6,300° F., and the area of this brightest spot is no more than the tenth of an inch square in such an arc. A stronger current does not make the spot brighter or hotter; it only makes its area larger, and this is the place which radiates the most of the energy and is comparable with the sun for brightness.

An arc having a similar bright surface a foot square would radiate $100 \times 144 \times 6 = 8{,}640$-horse power, which is nearly the observed amount from the sun. The tenth of an inch square for the dimensions of the bright spot is a very liberal estimate for an arc taking six-tenths of a horse power. If it should be reckoned to be a trifle smaller, say the twelfth of an inch square, then the resulting figures would be, for a square foot, $144 \times 144 \times 6 = 12{,}441$-horse power, which is in excess of the sun's rate. From these facts it seems clear that the temperature of the sun does not need to exceed that in an electric arc, or 6,300°, in order to shine as brilliantly and radiate the observed amount of energy.

Things Seen by an Engineer in a California Electric Light Station.

An engineer who recently "looked over" an electric lighting plant on the Pacific slope, had this to say about it when the inspection was at an end:

A barn seems to be the proper kind of a building in which to place electric machinery, engines, boilers, etc., for a central station, that is, if the barn happens to be located in the central part of the city.

I think this station one of the best and most conveniently arranged places I have ever seen—for a man in poor circumstances, who has an accident insurance policy, or is desirous of assisting his family by sacrificing a few limbs for good fat damages. High-speed belts are more plentiful than passage ways, and there are no guards nor rails to prevent a man from trying the speed of the belts. In fact, there are some things that would be of considerable assistance to him in such an undertaking. There are belts running just a little below the surface of the floor, which is well lubricated and slushed.

If a man got into one of the belts, or took a few turns around the un-

protected ends of one of the shafts, I think that his family would be entitled to all that the law allows.

Speaking of the floor, it was impossible to tell what it was made of. However, there was oil and dirt in a great number of layers. One of the attendants was directed to clean up the floor, and started in with a hoe. I advised him to get a plow to start with, but he thought he could find bottom after a while without it. No rubber mats are used around the dynamos, and on asking if there were none around, I was informed that oil insulation was the latest fad. This is certainly an economical idea in a place where two 50-light arc machines are run in series.

All station and switchboard wiring is done with weatherproof wire, whether it be a 1,000-volt alternating circuit, or a 4,000-volt arc circuit.

The switchboard connections are a puzzle beyond solution, and the arc switch switchboard is located in a small bay, with the incandescent switchboard in front, making practically a closet of it. This closet seems to me peculiarly adapted for electrocution purposes.

Light where it is manufactured seems to be a luxury. There are in this station eleven 16-candle power incandescent lamps and one poor arc lamp to give the necessary light to operate 5 engines and 10 dynamos. As for reading the instruments during the tests, I found it necessary to use a lantern. This lantern was, I suppose, the emergency light of the station, and had a globe which I was told was broken last winter. All the lantern oil in the place was in the lantern, and lasted for about two hours. The interesting points were very numerous, but their general tenor was monotonous and uniform, and it is needless to say that the station was not paying very large dividends.

Petroleum and Asphalt in Eastern Europe and Asia.

The petroleum of Galicia has been worked for at least 35 years. The first systematic development of this industry took place in the Bobka district. In 1861 the first well, 14 meters deep, supplied 6,000 kilogs. of oil per hour. In 1883 this district supplied per day 550 barrels of raw petroleum from a surface of 1,500 meters long and 350 to 500 meters broad.

In certain places a reddish oil is found, which can be burned in a raw state in ordinary lamps. The oil of the bored wells is very fluid, but the surface oil, which comes from shallow wells, is sometimes a little viscous.

Moreover, Galicia produces a certain amount of ozokerit, which is understood to be a species of petroleum in a state of high ebullition. The chief center of the mining industry of ozokerit is Boryslaw, in a valley surrounded with hills on the northern slope of the Carpathians, 360 meters above the sea. At Truskowics there is a deposit of native sulphur mixed with clayey schist, ozokerit and petroleum. The ozokerit presents itself under the form of veins of variable thickness, some being several millimeters and others several decimeters thick; the upper beds, which form the richest portion of the deposit, occupy an area of about 21 hectares, but a less productive zone extends the total superficies to about 60 hectares.

The petroleum lands of Roumania constitute the great hope of the future for petroleum, whether we regard the extension of the ground already worked or the discovery of new petroliferous regions.

In the neighborhood of Okna, on the further side of the Eastern Carpathians, in the valley of Trotush, an affluent of the Sereth, some 30 wells are dug in a clayey soil producing salt and petroleum. In some of these petroleum is found in considerable quantities. At Slanick, opposite Okna, ozokerit has been found.

On the confines, too, of the territories of Grochezti and Hirka, several wells have been dug, in which petroleum is found at a depth of 40 meters.

But it is in the Moniezti district, north of Okna, that the most considerable workings of mineral oil are concentrated. The petroleum wells, to the number of a hundred, are concentrated to the north of the village, and the ground worked may cover a circular surface of from 15 to 16 kilometers in diameter.

The petroleum of Teskani is beyond contradiction the purest in all Moldavia, its composition and density approaching that of naphtha. It weighs only from .76 grms. to .79 grms., whilst that of Moniezti weighs from .84 grms. to .87 grms., as compared with water 1.

In continuing progress along the eastern slope of the Carpathians, to the south of Teskani, we meet at Modreni with new beds of worked petroliferous clays. The petroleum is here obtained from some 30 wells, the depth of which varies from 35 to 45 meters. The Modreni petroleum is the best which Wallachia produces, and can bear comparison with the most accredited yield of Pennsylvania.

Sarrata is a commune situated to the north of Buseo, and is one of the markets of Wallachia which, after the district of Plojesti, yields the greatest quantity of petroleum, but of a very poor quality, the oils being extremely charged with tar.

At Plojesti the petroleum wells, to the number of 100, and all of them active, are bored in the clay. It is the same at Baikoi and Tsinta, where the same salt-bearing clay occurs, with beds below of white lamellated gypsum.

To the north of Matitza the petroliferous clays of Poccurezza are considered as the cradle of the petroleum industry of Roumania.

Finally, beds of petroleum are met with at Campina, 60 kilos. to the north of Bucharest, on the high road to Brasso (Cronstadt).

The basin at Selenitza, in Albania, includes a bed of solid bitumen, which is in some places 3 meters thick. This bitumen is, according to Coquand, petroleum which has reached the extreme limit of exhaustion, reduced into a solid substance, incapable of spontaneous decomposition, and of the generation of new secondary products. Under analysis the maltha of Selenitza yields the following results: Oil of petroleum, 43 per cent.; coal that can be turned into coke, 43 per cent.; residue, 14 per cent.

In passing from the camp at Selenitza to the Vojutza, hills which contain deposits of bitumen are met with. The plain which separates the mountainous region from the river is sprinkled with fragments of bitumen which the water has dragged down with it, some of which, in the great floods, is carried to the shores of the Adriatic. The abundance of this debris shows how rich the deposits must be from which they come, and recalls to a certain extent the fragments of bitumen which the Black Sea throws up upon its shores.

It is on the banks of the Vojutza, on a level with the blue clays, that the remarkable phenomena of the air volcanos make their appearance. The more majestic of two that have been examined was placed above a bed of gravel, in the form of a very flattened cone, surmounted by a regular crater of more than a meter in diameter, which was filled with a liquid and transparent water. At intermittent periods, varying from 50 to 55 seconds, the water in the crater was violently shaken by an escape of gas, which broke the surface in the form of great bubbles. Each emission, which overflowed the walls of the crater, ran down over the sides of the cone, the thickness and circumference of which were thus being steadily increased, and then was lost in the quiet waters of a bay formed by the Vojutza.

The old cast-up matter, which lies at a short distance from the crater, becomes as thick as printer's ink, and is able to bear the weight of objects upon it; a man's foot would gradually sink in it if it were left there long enough.

In the island of Zante, the petroleum is found in clays lying under marshy ground, and attempts have been made to sound the depth of these beds. In one case they went down 150 meters and tapped the petroleum bed at 48 meters, producing at once about half a ton. Another boring went down 150 meters without getting beyond the blue clay and without any result. A third at 21 meters supplied 1,111 gallons within seven hours, and then became absolutely sterile.

The mineral oils of Chieri are very heavy and of inferior quality, which is easily to be accounted for. The disengagement of inflammable gas for centuries has deprived them of their lighter qualities. It is even reasonable to conjecture that this spontaneous distillation will gradually lead to their impoverishment and complete exhaustion, when they will be finally transformed into solid bitumen, as has already happened in the beds of the Dead Sea and of Selenitza.

The asphalt beds of Russia are found to the west of the great curve of the Volga, on the right bank, a little above the town of Sizrau, and along an extent of 20 kilometers. There are known three beds of them, the lowest of which is the best; this contains from 24 to 36 per cent. of bitumen, the point of fusion of which is much higher than that of the French and Swiss bitumens.

The asphalt diggings have been worked since 1874. They are worked in quarries open to the sky, and they serve to manufacture asphalt putty in three factories, the most important of which is in the town of Sizrau. The free bitumen necessary to this manufacture is extracted from bituminous sandstone in the district of Sizrau, 80 kilos. to the east of the beds of asphalt.

The bitumen commonly called Judean bitumen exists in the calcareous cretaceous rocks of the valley of the Jordan and of the banks of the Dead Sea. In this region in particular it is tolerably abundant, since it leads to an oozing or trickling in a glutinous form, which hardens into a solid resinous mass. There are also beds of asphalt in Hungary, in the county of Bihar, at Felsio-Derna, Mezo-Telegd and Tataros. The works are carried on by two joint stock companies employing about 1,230 workmen.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At the annual meeting of the shareholders in the Bridgeton (N. J.) Gas Light Company the officers chosen were: Directors, Chester J. Buck, Daniel Elmer, Henry W. Elmer, Daniel Bacon and George H. Whipple; President, Daniel Elmer; Secretary and Auditor, H. W. Elmer; Treasurer and Superintendent, B. F. Harding. The business of the Company is quite satisfactory to the proprietors. Many substantial improvements have been made on the works this season, included in which is a bench of 6's.

At the annual meeting of the Long Branch Lighting Company, of Long Branch, N. J., the Directors named were: George F. Baker, C. H. Irwin, Jacob Steinbach, H. E. Gawtry and George N. Curtis. The Directors subsequently perfected the following organization: President, H. E. Gawtry; Vice-President, Jacob Steinbach; Secretary, C. H. Irwin; Treasurer, George N. Curtis; Superintendent of gas plant, C. J. Luther; Superintendent of electric plant, Alex. Anderson.

The Troy (N. Y.) Gas Company will build a new dock, fronting its property at the foot of Division street. It will be 125 feet in length, will have a return of 10 feet and a height of 12 feet.

The Universal Gas Company, of Chicago, Ills., has filed with the authorities a notification of a decrease in its capital stock from $5,000,000 to $1,500,000, and an increase in the number of its Directors from three to five.

It is said that the parties in interest behind the recently acquired Hiscock-Dunfee opposition gas charter for Syracuse, N.Y., are the proprietors of the Philadelphia Gas Improvement Company; and it is also said that they would like to purchase the properties and possessions of the Gas Light Company, of Syracuse. Of this desire we have no doubt; but the Philadelphia gentlemen will, if they secure that plant, have paid its present owners every cent it is worth.

The Mount Holly (N. J.) Company has made considerable additions to its main system this season.

The Niagara Falls (N. Y.) Gas Company recently applied for an injunction to restrain the Hoyt Inspection Company from interfering with the meters of its consumers—the Inspection Company is engaged in persuading consumers to have their meters tested, without applying for permission to the Gas Company for its consent to such tests. Judge Ward, before whom the application was made, decided that no injunction should issue, and gave no reasons for such opinion, merely handing down a negative decree.

At the annual meeting of the Oswego (N. Y.) Gas Light Company the following result was reached: Directors, Thomson Kingsford, Jas. Dowdle, Theo. Irwin, J. T. Mott, Robert G. Post, H. G. Ludlow, H. H. Lyman, H. D. McCaffrey and H. S. Wright; President, Jas. Dowdle; Vice-President and Treasurer, John T. Mott; Secretary, Robert G. Post. A glance at the list of officers chosen to manage the affairs of the Home Electric Light Company is all that is necessary to prove that the interests of the Oswego Gas Light Company and the Home Electric Light Company are identical.

The contract entered into between the local authorities of Spencer, Mass., and the Spencer Gas Company, on public lighting account for the ensuing year, calls for the maintenance of 70 arc lamps (1,200-candle power), to average not less than 22 nights per month (on an all-night table), at the rate of 27 cents per light per night. Last year the contract rate was 27.7 cents per light per night.

Secretary Horton, of the Rahway (N. J.) Gas Company, has met with great success in placing Welsbach lamps in that city.

The Boston Electric Light Company has petitioned the Board of Gas and Electric Light Commissioners for permission to increase its bonded indebtedness in the sum of $250,000.

The investigation into the accounts of the Richmond (Va.) City Gas Works shows a deficit of $25,056.20, the largest portion of which ($22,907.63) is charged against the coke sales. Mr. H. B. Boudar, the expert accountant who examined the books, declares that the irregularities in this instance covered a period of several years. The Light Committee, of City Councils, in consequence of this statement, recommend the discharge of a foreman and a clerk.

At the annual meeting of the Gas Light Company of Columbus, Ga., the Directors chosen were: T. E. Blanchard, J. B. Holst, D. F. Willcox, W. L. Clark and T. D. Huff. The Directors named the following executive management: President, T. E. Blanchard; Secretary and Treasurer, T. D. Huff; Supt., Jas. Ferrier, who succeeds Mr. E. H. Jenkins, the latter having, as stated some weeks ago in the Journal, accepted the management of the works of the Covington (Ky.) Company. The Directors of the Columbus Company also took the following action in respect of the retirement of Mr. Jenkins from their service: "On motion of Mr. Willcox, the resignation of Mr. E. H. Jenkins, as Superintendent, was accepted, and the President was instructed to express to Mr. Jenkins the sincere regrets of the Directors in consequence of the loss of his services, and the severing of a connection which for the past ten years has been so entirely satisfactory and pleasant. The Directors desire to have this testimonial officially conveyed to Mr. Jenkins, coupled with the expression of their earnest wishes for his continued success and prosperity."

The Chelsea (Mass.) Gas Company has declared a dividend of $2 per share, payable now to shareholders of record July 11.

The offices of the Meriden (Conn.) Gas and Electric Light Company will be removed on August 1st to a store on the ground floor of the Winthrop Building. This judicious determination will put the Company's offices in the business center of the city, and will further enable it to carry a line of gas cookers, etc.

At the annual meeting of the shareholders in the Milford (Mass.) Gas Light Company the Directors chosen were: Messrs. C. F. Claflin, B. E. Harris, J. B. Bancroft, E. L. Wires, G. A. Draper, N. B. Johnson, F. J. Dutcher, I. N. Davis, J. E. Walker and L. H. Cook. The organization meeting resulted as follows: President, C. F. Claflin; Treasurer, B. E. Harris; Secretary, L. H. Cook. The annual reports were of a most satisfactory nature.

Registrar Jacob Lang, of the Philadelphia Gas Bureau, has perfected a plan for the establishment in that city of two, possibly three, additional branch offices for the greater convenience of those who burn gas. As the scheme has been approved by the Director of Public Works (Mr. Thompson), there is little doubt that it will go into effect on or before September 1st.

At the annual meeting of the New London (Conn.) Gas Light Company the officers chosen were: Directors, J. N. Harris, Augustus Brandagee, L. E. Lippitt, Robert Colt, T. W. Lippitt, A. C. Lippitt and C. C. Lippitt; President and Superintendent, A. C. Lippitt; Secretary and Treasurer, C. C. Lippitt.

The Washington *Post* says that a sale of real estate in the District of Columbia, belonging to the Chesapeake and Ohio Canal Company, and occupied by the Washington Gas Light Company, under a 50-year lease since March 1, 1873, was authorized on the 11th inst. by Judge Cole, in Equity Court, No. 1. This was done on the petition of George S. Brown, Jas. Sloan, Jr., and Lloyd Lownde, Jr., trustees under the mortgage deed of trust, of June 5, 1848, and also under the mortgage deed of trust, dated May 18, 1878. The sale is to be made under foreclosure proceedings, but this is done with the consent of both parties. The Gas Company has made an offer of $100,000 for the property, which comprises two parcels of land east of Rock Creek, one of which has 56,973 square feet of land and the other 118,324 square feet. The Gas Company has been paying a rental of $2,200 a year for these. The sale is to be at auction in five days to satisfy the mortgage bonds of May 18, 1878, aggregating $817,548.17, and Mr. C. T. F. Beale is named as trustee to effect the same under a bond of $100,000. If there are no higher bidders the property is to be conveyed to the Gas Company for the price offered.

The Vancouver (B. C.) Gas Company has made a proposition to the authorities to perform the public lighting of that place by means of Welsbach lamps, and the authorities seem favorably inclined. The trial lamps erected at prominent points have answered the requirements in every particular.

The new coal storage sheds of the Cumberland (Md.) Gas Light Company are almost completed. Paving brick was used in the wall construction, and the local papers say that it is a very handsome building—a verdict that does not often truthfully apply to coal storage houses.

At a recent meeting of the Salinas (Cal.) Council a communication from the Salinas City Gas and Water Company, offering to refer the

matter of fixing the value of its plants to arbitrators, was considered—the authorities are desirous of operating the plants on municipal account. The result of the consideration was that the City Clerk was notified to inform the Company that the Council would agree to the proposition, "providing the said Company will furnish data to enable the Council to arrive at a correct value and cost of said plant."

THE Hartford (Conn.) *Courant* says that the Citizens Gas Company, of Bridgeport, Conn., is getting ready to begin work on the construction of its buildings, which are to be located in the west end of the city. The first move was to mortgage all charter rights, privileges, franchises, property and appurtenances of every description, to the Knickerbocker Trust Company, of New York, which, according to an indenture made between the two Companies, will issue bonds in the name of the Citizens Gas Company amounting to $1,000,000. The Citizens Company is the concern in which Burdett Loomis and others are interested, their nominal object being the supply to Bridgeport of fuel gas.

AT the annual meeting of the Consolidated Gas Company, of Baltimore, Md., the officers chosen were: Directors, E. C. Benedict, W. B. Brooks, Wm. F. Burns. Bernard F. Cahn, W. F. Frick, Jas. A. Gary, John W. Hall, Henry James, D. D. Mallory, Wm. W. Spence, G. A. von Lingen and John E. Hurst; President, John W. Hall; Vice-President, Jas. A. Gary; Secretary, N. T. Meginnis; Treasurer, Joseph W. Clark.

MAYOR ORR, of Tacoma, Wash., has vetoed the ordinance under which it was proposed to compel the local Gas Company to sell gas for lighting purposes at $1.50 per 1,000 cubic feet and at $1.25 per 1,000 for fuel uses—a reduction of 50 cents per 1,000 from the ruling rates. The Mayor thought the reduction was too radical, since it would oblige the Company to sell gas at lower rates than those prevailing in San Francisco, where the gas output was vastly greater than the output at Tacoma. Furthermore, the Mayor was satisfied that the Tacoma Company had not been making an undue profit at the rates charged.

JUDGE JOHN F. DILLON, of New York, who is a large holder of shares in the Tacoma Gas and Electric Company, and who passes upon all the important legal matters of the Company, when the provisions of the proposed ordinance were referred to him for an opinion thereon, replied that he believed the ordinance was unconstitutional, the Company's charter, granted in 1884 to Mr. John W. Sprague, specifying that the rates for a lighting supply must be "reasonable." Further than that, the franchise does not reserve to the Council any authority to regulate rates; that whether rates are "reasonable" or not is a question to be decided by the courts, and not by either of the parties in interest; that the franchise constitutes a contract which cannot be violated by the Council under the constitution and laws of the State and the city charter.

THE stock dividend of 25 per cent., recently declared by the proprietors of the Nashville (Tenn.) Gas Light Company, according to the statement of Gen. W. H. Jackson, President of the Company, "represents an increase in capitalization, based on actual improvements, of 20 per cent., and one semi annual dividend of 5 per cent., and nothing else."

THE proprietors of the Jamaica Plain (Mass.) Gas Light Company have purchased a plot of land on Williams street, to replace the property taken by the Providence Railroad Company for the widening of its tracks. The plot now acquired adjoins the property occupied by the Gas Company.

THE settlement of the gas rate question at Montreal, Canada, will likely be made on the following basis: The agreement is to last for 10 years, during the first half of which the Company may charge $1.20 per 1,000 cubic feet for a lighting supply and $1 per 1,000 for a cooking, heating and power supply; the prices to rule for the remaining half being $1.10 and 90 cents, according to the purpose for which the gas is used.

HAVING heard argument on the petition of the Selectmen of Blackstone, Mass., to the Board of Gas and Electric Light Commissioners, for a revision of the rate charged for the arc lighting on public account of that place—the lighting is carried on by the Woonsocket (R. I.) Electric Machine and Power Company, for Blackstone, although located in Massachusetts, is virtually a suburb of Woonsocket—the Commissioners decided that the price should be cut to 42 cents per arc per night from 50 cents. The Company flatly refused to accept the recommendation, and in view of the fact that this is the first instance of such refusal in the records of the Commission, we append the correspondence between the Board and the Company over the question at issue:

COMMONWEALTH OF MASSACHUSETTS,
IN BOARD OF GAS AND ELECTRIC LIGHT COMMISSIONERS,
BOSTON, July 8, 1895.

On the petition of the Selectmen of the town of Blackstone for a reduction and adjustment of the price to be paid for electric street lights supplied by the Woonsocket Electric Machine and Power Company,

Ordered, That, on and after the 15th day of July current, the price for electric street lights of nominal 2,000 candle power, burning all night and every night in the year, in the town of Blackstone, and supplied by the Woonsocket Electric Machine and Power Company, shall not exceed 42 cents per light per night. By the Board,

FORREST E. BARKER, Chairman.

OFFICE OF WOONSOCKET ELECTRIC MACHINE AND POWER CO.,
WOONSOCKET, R. I., July 10, 1895.

Board of Gas and Electric Light Commission, Boston, Mass., F. E. Barker, Chairman:

Dear Sir—I am in receipt of your order of July 8 in reference to price to be charged to the town of Blackstone for electric lights of 2,000 candle power. I conclude, whether wisely or not time will tell, your Board are disposed to force this issue into the court. It seems to me and to this Company that the people of Blackstone should be able and competent to make their own contracts for street lighting without the solicitation of your help, by a few leaders to act for them. In lighting said town, whether with the present lamps or lamps of lesser energy, we should require a contract with the town covering a term of years, a contract which your Board or the Electric Light Committee would not have power to make, and such contract would have to be authorized in a regularly-called town meeting, an action which has not yet been taken. As you are aware, we have several times extended their present service for a short period at the request of the Electric Light Committee, authorized so to do, pending a decision of the question in above manner. In the true condition of matters, as it now stands, your order is, to say the least, somewhat premature, as no vote authorizing any action whatever on your part has been passed by the voters of the town. Again, do we understand by this order that your Board would go as far in case such vote should be passed and the voters should by a majority decide to renew the contract at its present price rather than dispense with the service, that you would say that no such contract should be entered into between the town and this Company? In this connection, bear in mind what I have repeatedly stated, that the people of Blackstone, as a whole, are so well pleased with their present service that if the matter was presented to them in a fair and impartial manner, not by a few with the grim determination to have what they want at any cost, the verdict will be very decided in favor of a continuance of the lights as they now receive them from this corporation. On the other hand, if the town does not so vote, and should instruct their proper officers to enter into a contract with us at the rate of 42 cents, which you recommend, then in that case all I can say is that one party alone cannot make a contract. Then will be the proper time for you, if you so desire, to order us to make a contract with the town of Blackstone on those terms, and in the event of our sure refusal you probably intend by some means or other to declare our legislative rights invalidated. When that time comes I assure you that we shall protect those rights to the best of our ability in any court or courts before which they may come for decision. The present contract expiring with Monday, the 15th inst., and there being no contract between this Company and the town of Blackstone of whatever nature to continue beyond that date, the service will cease with that termination until some new contract shall be entered into. To any impartial person it is conclusive that if a price of 35 cents per light charged in Boston for 2,000 lamps of equal energy is just and equitable, then the price which we here maintain for 29 lamps is not unreasonable, and we would be pleased as a corporation to enter into a contract with Blackstone or any other municipality adjacent to us for one-half the number of 2,000 lights of 2,000 candle power at the price of 35 cents, and that, too, with fuel at a cost to us of $1 per ton, as it now is, over and above the price paid in Boston or other places on the tidewater. Respectfully yours,

L. C. LINCOLN, Gen'l Mangr.

AT the annual meeting of the Municipal Gas Company, of Albany, N. Y., the officers named were: Directors, R. P. Flower, E. C. Benedict, R. C. Pruyn, W. McEwan, Jno. E. McElroy and A. N. Brady; President, A. N. Brady; Vice-President, R. C. Pruyn; Secretary and Treasurer, Jno. E. McElroy; Assistant Secretary, Henry Bronk.

THE AMERICAN GAS LIGHT JOURNAL

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MONDAY, JULY 22, 1895.

Spectroscopic Study of the Carbons of the Electric Furnace.

By H. DESLANDRES.

H. Moissan has recently announced (*Comptes Rendus*, cxix., p. 1,245) that the carbons of the arc in his electric furnace are purified by the passage of currents of great intensity, and are thus freed from the foreign matters which they always contain in notable proportion.

We know that it is very difficult to purify charcoal by chemical means. This property of the electric furnace is therefore important, and in particular it interests spectroscopists who in their researches of qualitative analysis often employ electrodes of carbon as pure as possible. I have thus been led to a special study of the carbons of the electric furnace, to ascertain on the one hand their value in analysis, and on the other to determine the complete spectrum of pure carbon.

Moissan having placed at my disposal two carbon poles, a positive and a negative (length of 0.20 meter and thickness of 0.05 meter), which had served in his experiments, I took from each pole small portions of charcoal at variable distances from the arc (0.15, 0.10, 0.05 and 0.01). Now the specimens the most remote from the arc still showed the rays of the ordinary impurities of charcoal, *i. e.*, the alkaline and earthy alkaline metals, with copper, iron, and silicon; but on approaching the arc, the rays of the impurities gradually diminished and finally disappeared, excepting only the rays of calcium, which, although much reduced, are still visible; this fact being due to the proximity of the sides of the furnace consisting of lime. These sides are themselves volatilized by very intense currents.

This purification of carbon seems to depend on a purely physical cause; the foreign matters, much more volatile than the carbon, are thrown off in the state of vapor. In fact, the purest parts of the two poles are the caps ("mushrooms," as the author calls them), which are formed at the negative pole of transportation from the positive pole to the opposite pole. With one of the caps the following spectrum of carbon has been obtained, containing fewer rays than the similar spectrum published by Liveing and Dewar, Hartley and Adeney, Eder and Valenta:

Intensities.	Wave Lengths.
8	426.70
5	392.17
4	391.97
2	316.83
1	316.57
2	299.34
1	296.77
8	283.75
8	283.69
4	274.75
3	264.12
8	251.19
8	250.79
10	247.88
8	229.70

The Market for Gas Securities.

The market for city gas shares was of the dull and uncertain kind up to Thursday of this week, when Consolidated showed unmistakable symptoms of distress, and the break came today (Friday.) The shares were offered down to 371½, but towards noon a recovery to 139½ was reported. There is no reason for the slump, and we advise the purchase of the shares at anything under 145, despite our knowledge that the season of midsummer dullness is on. Other city shares are inclined to weakness. The Brooklyn situation remains unchanged, quotations being on the nominal order solely. Chicago gas was the feature in the out-of-town shares, and the price broke 50 for the first time in many months. At noon to-day the price was 53 to 53½. No one can make a mistake in buying Chicago gas at the ruling figures. Detroit Consolidated 5's have sold up to 72½, and Baltimore Consolidated is offered at 63½. Bay States are in somewhat better demand at 19½ bid, and Lacledes seem still disposed to seek lower levels—that is, in respect of the common and preferred, for the bonds are in slightly better demand, at increasing prices. The Newark, N. J., consolidation and capitalization is all but completed, and the terms thereof seem to be quite satisfactory to all concerned.

Gas Stocks.

Quotations by Close & Nash, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

JULY 22.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	139	139¼
Central	500,000	50	140	..
" Scrip	220,000	..	100	..
Equitable	4,000,000	100	194	197
Bonds, 6's	1,000,000	1,000	106	..
" 1st Con. 5's	2,300,000	1,000	106	..
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	170	..
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	..	..	.
Northern	150,000	50	90	91
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	30	32
Preferred	2,000,000	100	55	57
Bonds	3,500,000	1,000	94¾	95¾
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	65	67
Preferred	5,000,000	100	106½	..
Bonds, 1st Mortgage, 5's	1,500,000	1,000	106	..
Yonkers	.....	50	101x	..
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	125	..
Citizens	1,200,000	20	65	..
" S. F. Bonds	320,000	1,000	..	101
Equity	2,000,000	10	..	..
" Bonds	1,000,000	..	..	..
Fulton-Municipal	3,000,000	100	175	..
" Bonds	300,000	..	108	..
Peoples	1,000,000	10	90	..
" Bonds, 7's	368,000	..	100	..
" " 6's	94,000	..	98	100
Metropolitan	870,000	100	170	..
" Bonds, 5's	70,000	..	..	..
Nassau	1,000,000	25	225	..
" Ctfs.	700,000	1,000	99	100
Williamsburgh	1,000,000	50	210	..
" Bonds	1,000,000	..	107	110
Out-of-Town Companies.				
Bay State	5,000,000	50	19¼	21½
" Income Bonds	2,000,000	1,000	33	..
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	..	79½
2d " " "	3,000,000	1,000	..	58
Buffalo Mutual	750,000	100	129	..
" Bonds	200,000	1,000	95	100
Chicago Gas Co.	25,000,000	100	53	53¼
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	93	93½
Columbus	1,000,000	..	..	..
1st Mortgage	1,085,000	..	..	..
Consumers. Jersey City	2,000,000	100	89	..
" Bonds	600,000	1,000	101	..
Cincinnati G. & C. Co.	7,000,000	100	208½	..
Consumers, Toronto	1,800,000	50	184½	187
Central, San Francisco	.....	..	90	100
Capital, Sacramento	.....	..	..	50
Consolidated, Baltimore	11,000,000	100	..	63¼
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,400,000	..	..	..
Detroit	4,000,000	..	29	..
" Con. Bonds	4,312,000	..	72	72½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	74	75
" Bonds	2,000,000	..	84	86
Hartford	750,000	25	120	128
Indianapolis	2,000,000	..	153x	..
" Bonds, 6's	2,650,000	..	106	..
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	84	86
Bonds	1,000,000	1,000	86	88
Louisville	2,570,000	50	..	120
Laclede, St. Louis	7,500,000	100	24	24¼
Preferred	2,500,000	100	82	88
Bonds	9,084,400	1,000	96	98
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	..
New Haven	.....	25	225	..
Northwestern Ohio Nat. Gas	.....	..	48	..
Oakland, Cal.	.....	..	42¾	43
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	2,100,000	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Paterson, N. J.	.....	25	99	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000	..	87¼	90
San Francisco, Cal.	10,000,000	100	72¾	73¾
St. Paul Gas Light Co.	1,500,000	100	68	70
1st Mortgage, 6's	650,000	..	..	..
Extension, 6's	600,000	..	..	..
General Mortgage, 5's	2,400,000	..	88	90
Syracuse, N. Y.	500,000	25	..	..
Washington, D. C.	2,000,000	20	250	..
Western, Milwaukee	4,000,000	100	64½	..
Bonds, 5's	3,556,000	..	92¾	..
Wilmington, Del.	500,000	50	188	190

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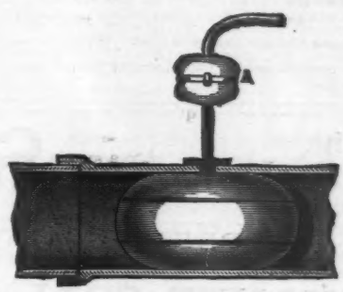

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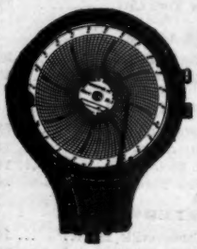

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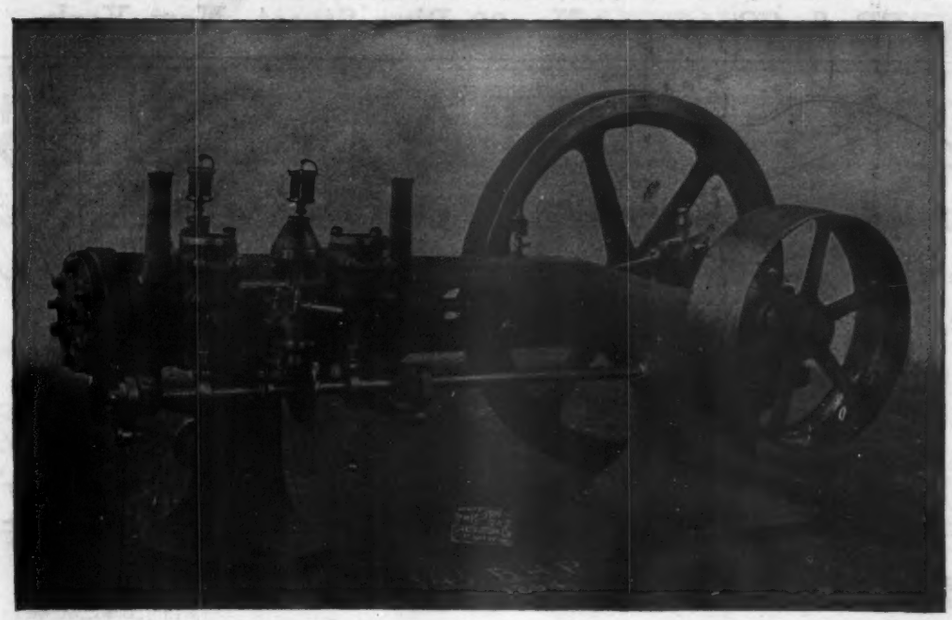

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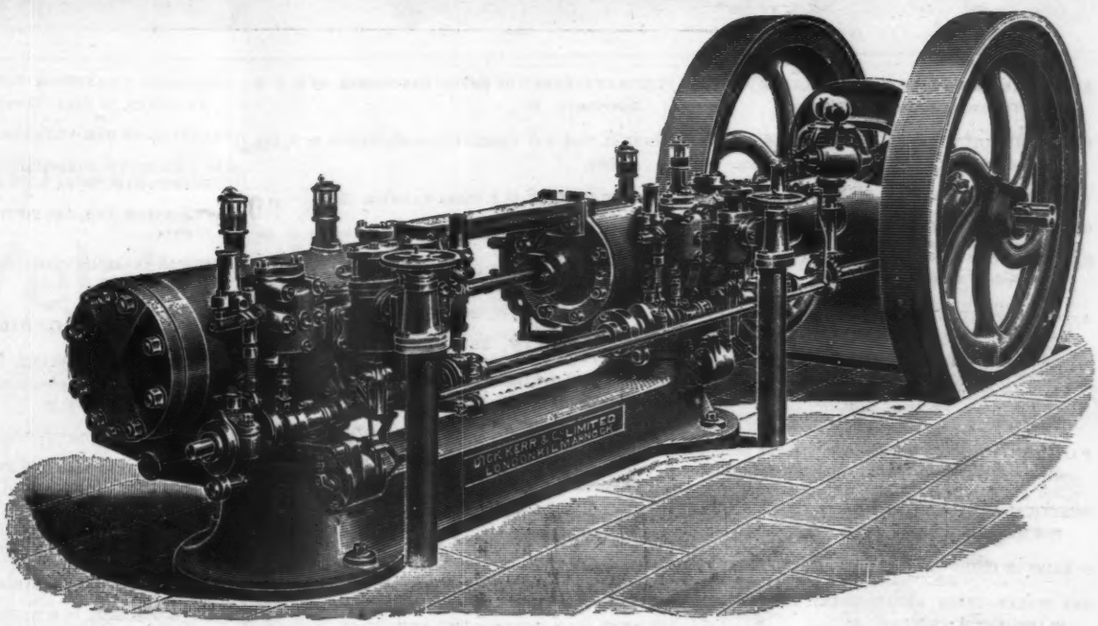

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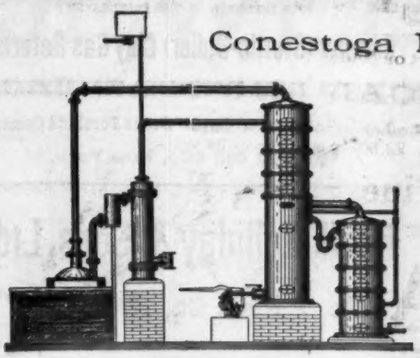

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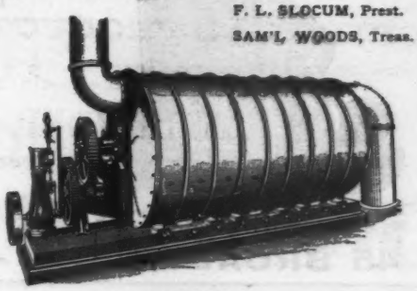

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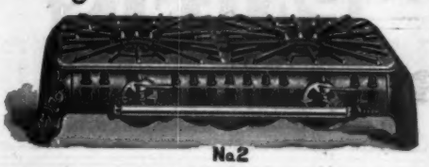

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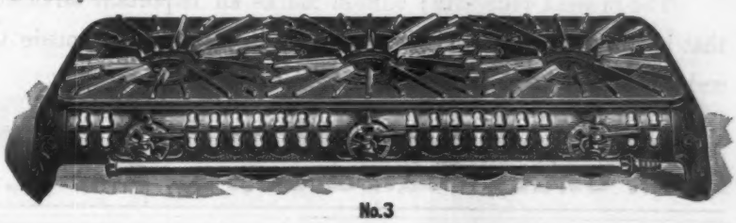

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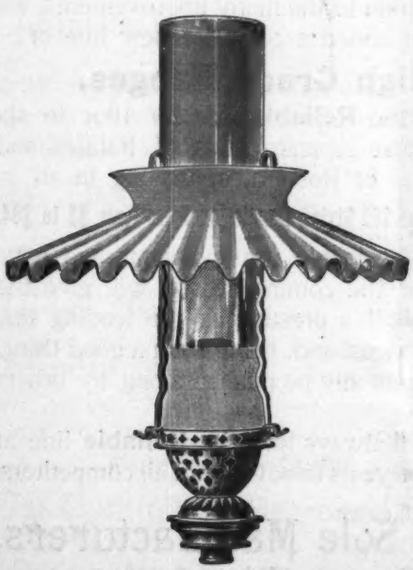

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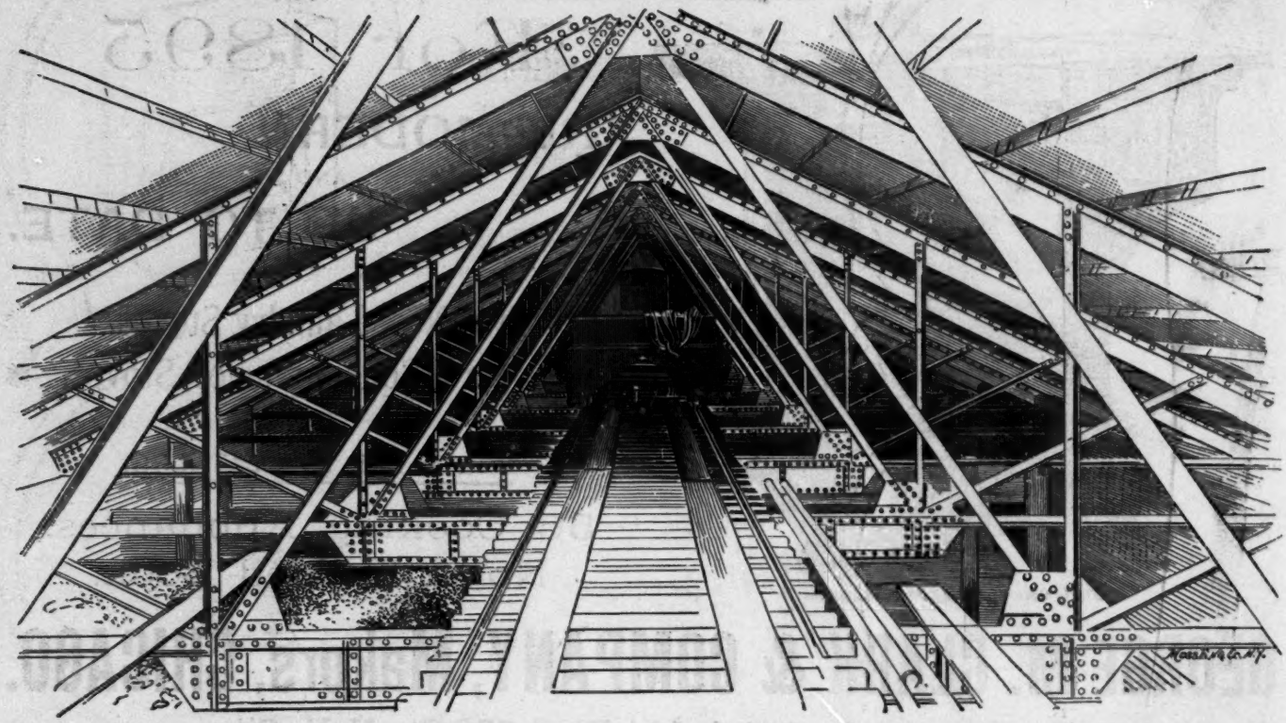

The above illustration is taken direct from a photograph, and shows an Iron Truss Roof designed and built by us for the Burlington City Water Works, at Burlington, Vt. The building is used for storing coal, and the roof is designed to carry a track through the trusses, so that the coal can be distributed from the car, and thus save handling. The roof is entirely of iron, no woodwork being used about it in any way, shape or manner, so that it is absolutely fireproof.

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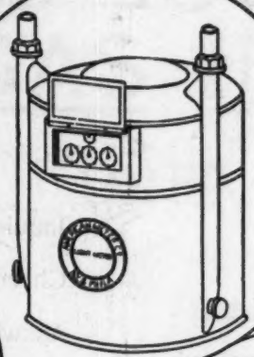

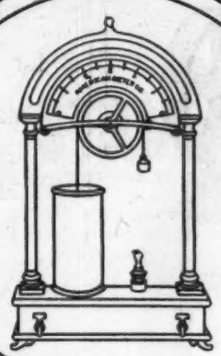

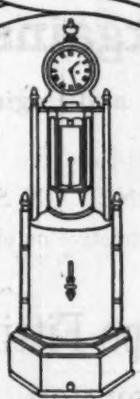

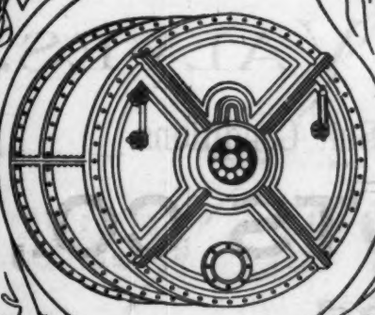

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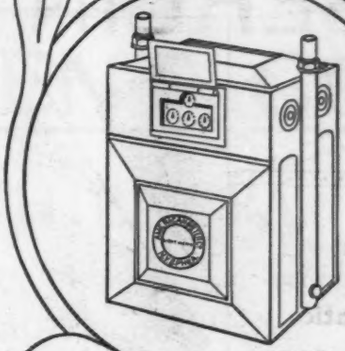
PUBLIC LIGHTING TABLE.

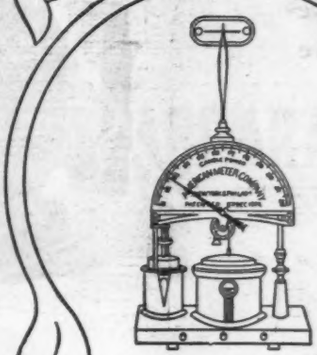
AUGUST, 1895.

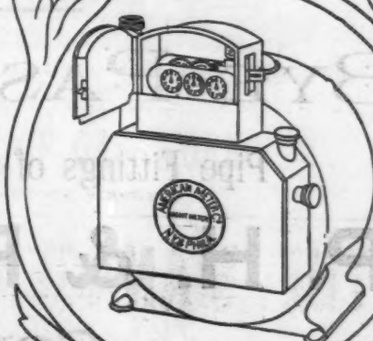
Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M.	A.M.
Thu.	1	12.40 AM	4.00 AM	7.10	3.30
Fri.	2	1.40	4.00	7.10	3.30
Sat.	3	2.40	4.00	7.10	3.30
Sun.	4	No L.	No L.	7.10	3.30
Mon.	5	No L. FM	No L.	7.10	3.30
Tue.	6	No L.	No L.	7.10	3.45
Wed.	7	7.40 PM	9.10 PM	7.10	3.45
Thu.	8	7.40	9.30	7.10	3.45
Fri.	9	7.40	9.50	7.10	3.45
Sat.	10	7.40	10.10	7.10	3.45
Sun.	11	7.30	10.30	7.10	3.45
Mon.	12	7.30	11.00	7.10	3.45
Tue.	13	7.30 LQ	11.30	6.55	4.00
Wed	14	7.30	12.10 AM	6.55	4.00
Thu.	15	7.30	1.00	6.55	4.00
Fri.	16	7.30	2.10	6.55	4.00
Sat.	17	7.30	4.20	6.55	4.00
Sun.	18	7.20	4.20	6.55	4.00
Mon.	19	7.20	4.20	6.55	4.00
Tue.	20	7.20 NM	4.20	6.45	4.10
Wed.	21	7.20	4.20	6.45	4.10
Thu.	22	7.20	4.20	6.45	4.10
Fri.	23	7.20	4.20	6.45	4.10
Sat.	24	7.20	4.20	6.45	4.10
Sun.	25	8.20	4.20	6.45	4.10
Mon.	26	9.00 FQ	4.20	6.45	4.10
Tue.	27	9.50	4.20	6.30	4.20
Wed.	28	10.40	4.20	6.30	4.20
Thu.	29	11.30	4.20	6.30	4.20
Fri.	30	12.40 AM	4.20	6.30	4.20
Sat.	31	1.40	4.20	6.30	4.20

TOTAL HOURS LIGHTING DURING 1895.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	237.00	January	423.20
February	196.40	February	355.25
March	195.50	March	355.35
April	165.30	April	298.50
May	153.40	May	264.50
June	138.20	June	234.25
July	146.30	July	243.45
August	152.50	August	280.25
September	165.10	September	321.15
October	186.10	October	374.30
November	204.10	November	401.40
December	219.30	December	433.45
Total, yr.	2161.20	Total, yr.	3987.45







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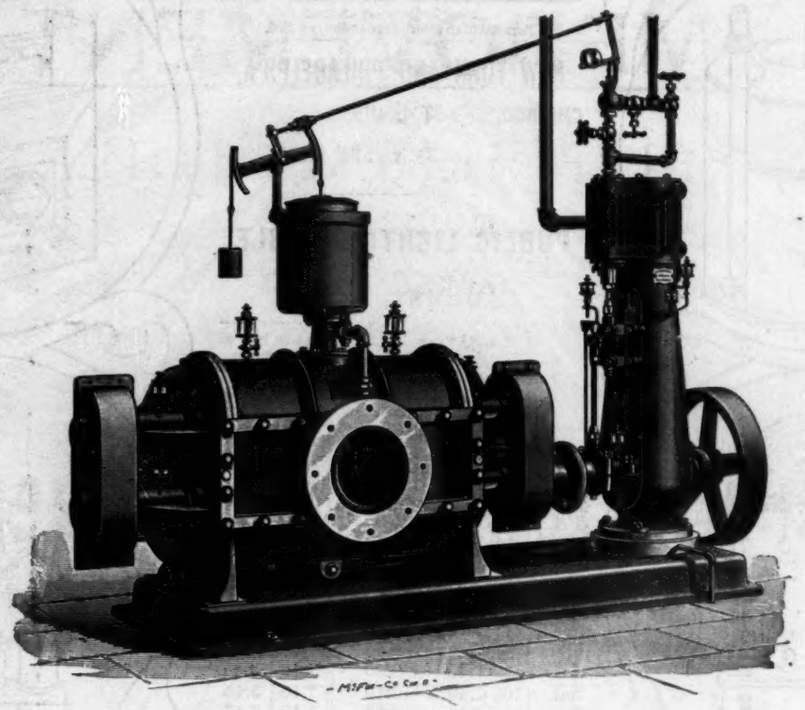

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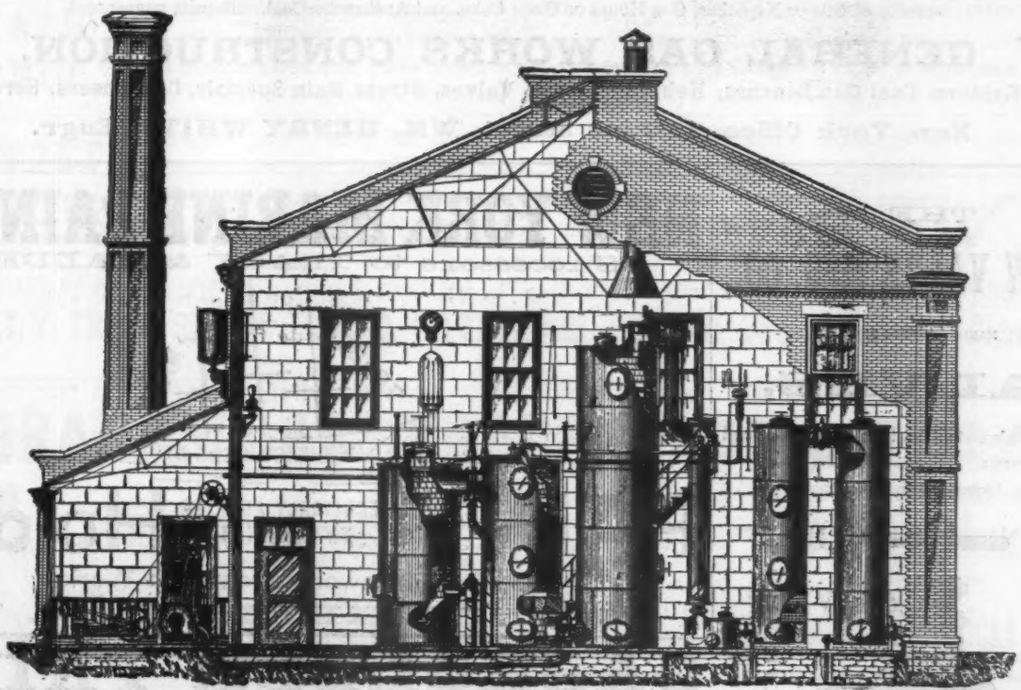

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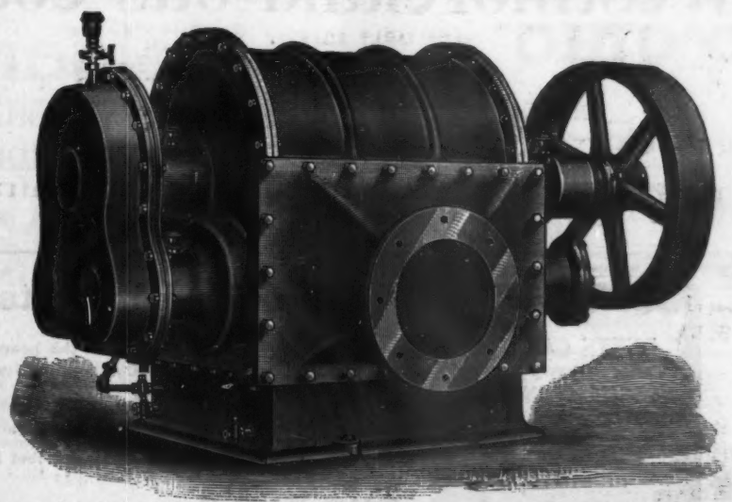

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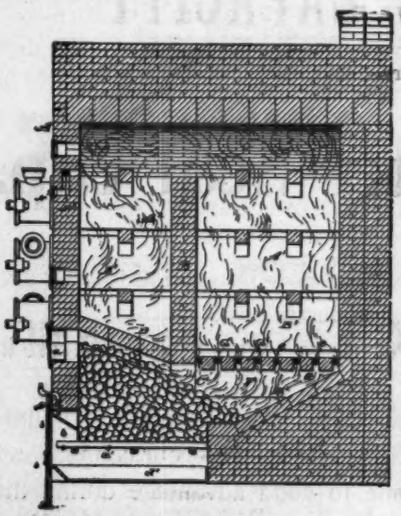

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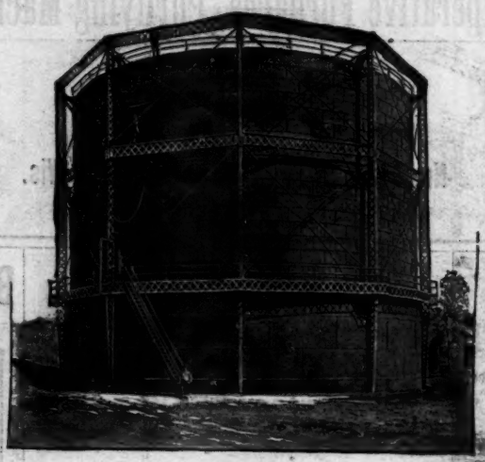

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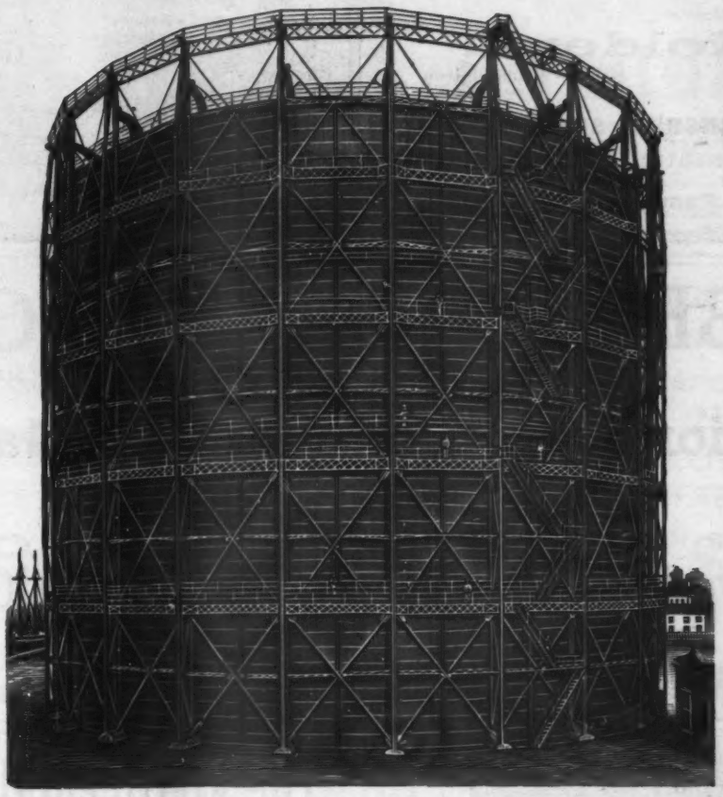

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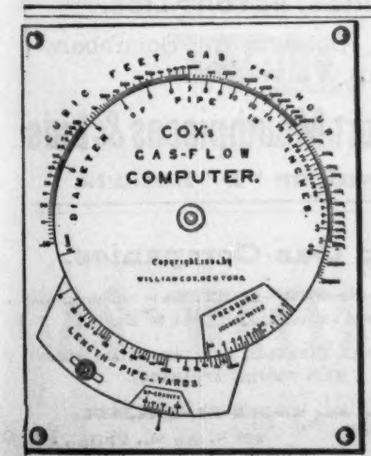

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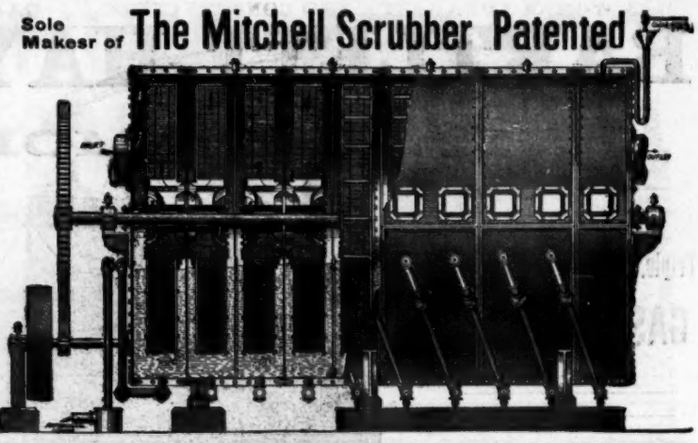

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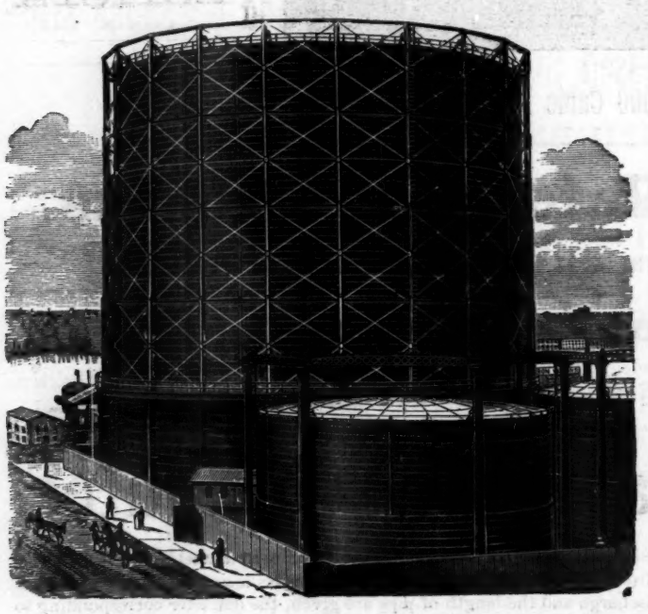

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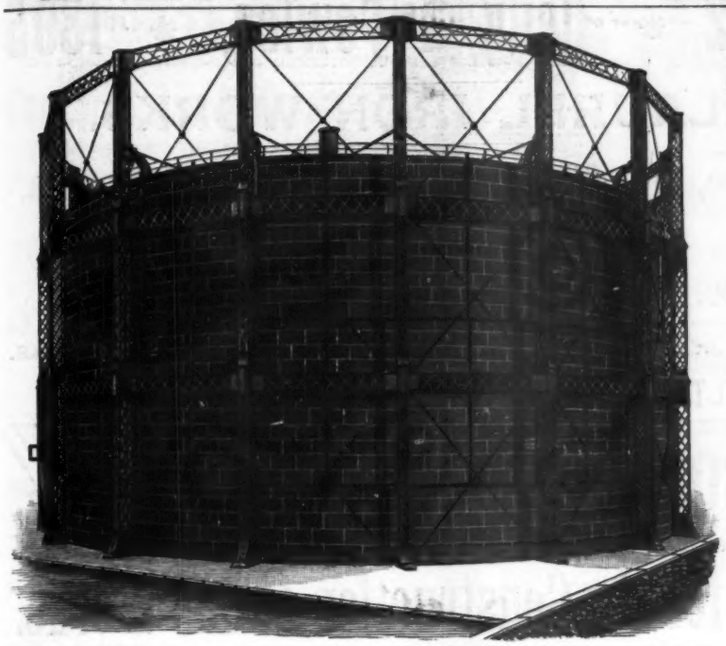

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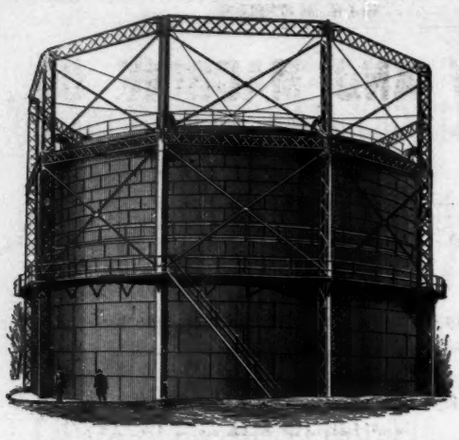

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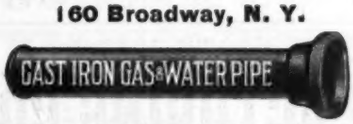

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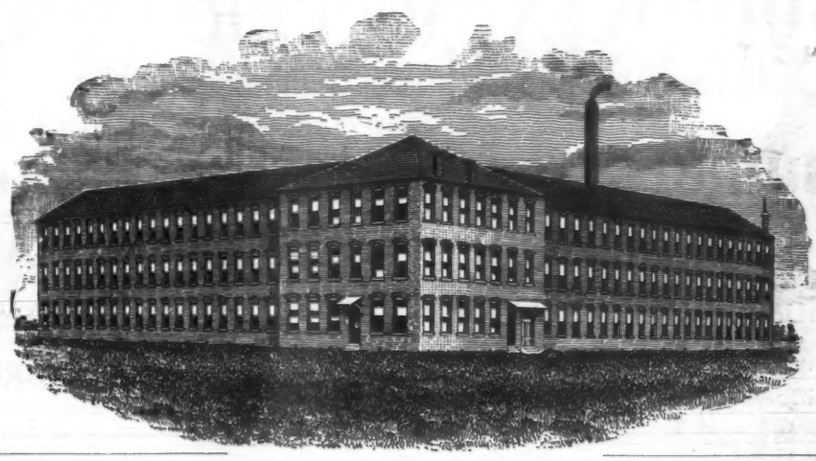

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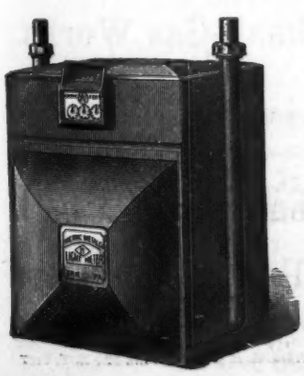

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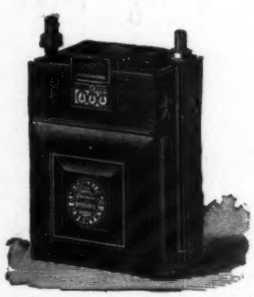

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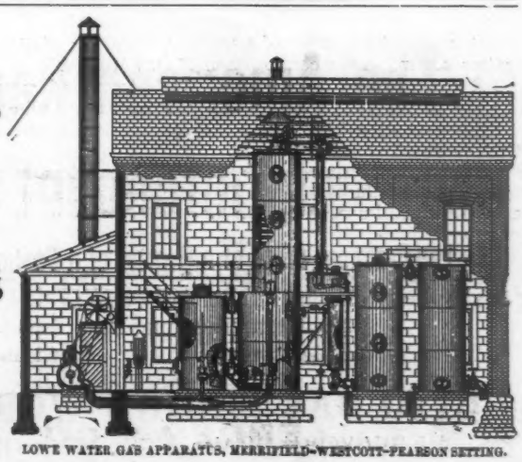

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The First to use the four-stroke cycle. **The First** to admit well measured and distinct charges of gas into an air space. **The First** in the adoption of poppet valves. **The First** to develop the tube igniter, with automatic or timed firing. **The First** to have a reliable electric and a practical magnectic igniter.

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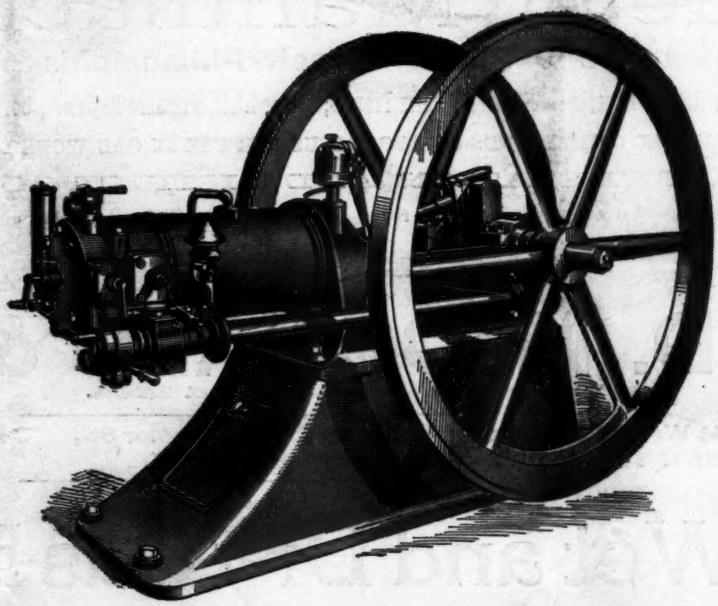

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